- ☑ AUSTRALIAN OWNED
- ☑ AUSTRALIAN MADE
- ☑ ISO 9001

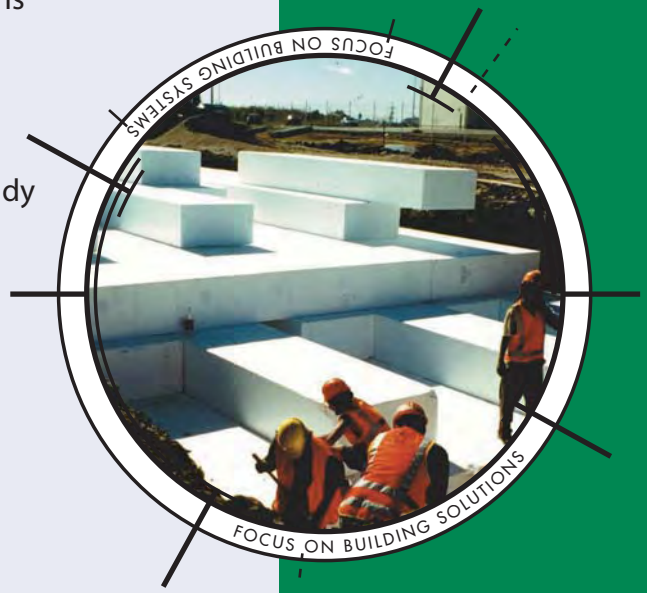
GEOROCK®
Geotechnical Lightweight Fill

Key product features of GEOROCK®

- ☑ Lightweight - easy to handle for fast fill situations
- ☑ Cost effective, reduced construction time
- ☑ 1/100th the weight of conventional land fill
- ☑ Long-term stability, will not decay, or turn mouldy
- ☑ Eliminates any lateral and vertical movement when placed on inferior load-bearing subsoil
- ☑ Remarkably high strength for density
- ☑ Compression sustainability
- ☑ Does not contaminate soil; is clean

GEOROCK® Common Applications:

- Geotechnical Fill over poor load-bearing subsoil for roadmaking or embankments
- Backfill
- Structural Fill
- Hillside Roading
- Embankments
- Repairing subsidence
- Bridging sensitive underground structures
- Replacement of poor soils
- Reduction of differential settlement
- Problem Sites
- Protection from frost heave



AUSTRAL INSULATION

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PRODUCT INFORMATION

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GEOROCK®
Geotechnical Lightweight Fill

Introduction

Geotechnical engineers and contractors in Australia and New Zealand are all too familiar with the problems of road construction in poor load-bearing areas. Traditional construction methods using conventional fill materials can be both impractical and uneconomic.

GEOROCK® is the perfect choice of material for this type of situation. Consisting of moulded Expanded Polystyrene (EPS), not only does our product offer a unique combination of very low density, significant load-bearing capacity and long-term stability, but it is also extremely fast and simple to install.

These features make GEOROCK® suitable for numerous other geotechnical applications where a dramatic reduction in vertical and/or lateral loads is required.

From initial trials of the product in Europe in the early 1960's, the use of EPS in geotechnical applications is going through a period of sustained growth worldwide.

GEOROCK® consists of expanded polystyrene beads moulded into solid blocks. Weighing in at approx. 1/100th the weight of conventional fill, GEOROCK® blocks virtually eliminate the lateral and vertical movement and complete bearing failure often associated with construction on poor load-bearing soil. There is also minimal settlement or long term compression of soil layers. This can lead to substantially reduced costs for structures, foundations or ground improvements and on-going maintenance costs. GEOROCK® also provides solutions to reduce loads on underground services, reduce lateral pressure and differential settlement at bridge abutments and aid in the reconstruction of embankments.

Application

GEOROCK® is a lightweight fill material that creates considerable programme efficiencies and is both cost competitive and easy to install.

Figures 1-7

APPLICATION PROFILES

Fig.1 CONVENTIONAL EMBANKMENT STRUCTURE

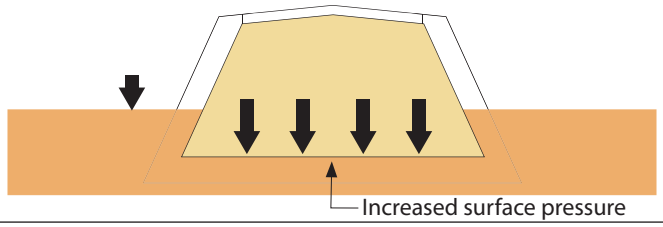


Fig.2 GEOROCK® EMBANKMENT STRUCTURE

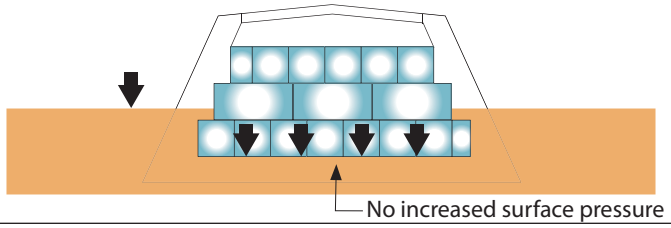
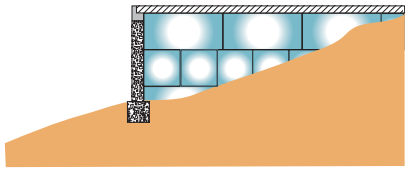
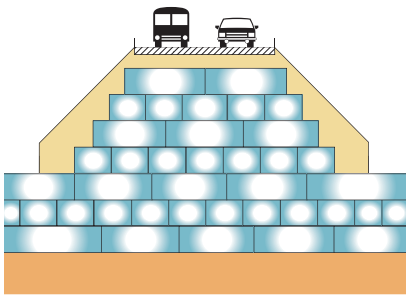


Fig.3 RETAINING COMMERCIAL AND RESIDENTIAL



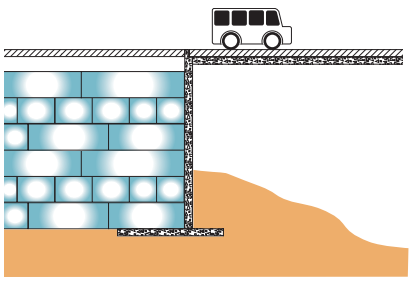
Austral GEOROCK® almost eliminates lateral loading on retaining structures

Fig.4 ROAD EMBANKMENTS



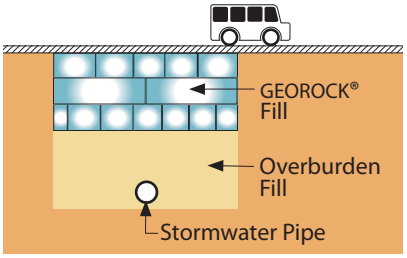
Reduce loads on subsoil compared to conventional embankments. This is the most common application for GEOROCK® so far.

Fig.5 ABUTMENT BACKFILL



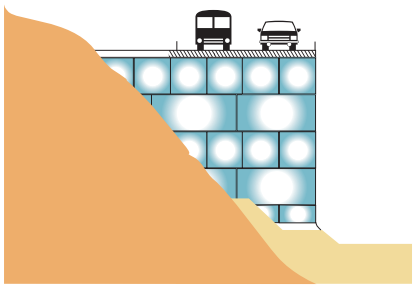
To reduce lateral pressure and differential settlement at bridge abutments.

Fig.6 LIGHTWEIGHT FILL



For the protection of existing underground services such as stormwater or sewerage pipe systems.

Fig.7 HILLSIDE ROADING



Construction of hillside roading embankments in steep terrain.

AUSTRAL INSULATION

GEOROCK® PROPERTIES

Compression

GEOROCK® is a thermoplastic material that under compressive load acts in a viscoelastic manner. This means that above certain levels of compressive load, blocks will not recover to their original thickness when the load is removed. Typically, GEOROCK®'s compressive stress at 10% compressive strain is the quoted performance characteristic, even though this is well into the region of permanent deformation.

To select the correct density, the elastic region of the compressive strain versus stress curve is of interest: Fig.8

The designer must ensure that the short-term design load combination (e.g. dynamic traffic loadings) is less than 1% of the initial compressive strain indicated for the chosen density in Fig.9

The long-term design load combination (that results from permanent loading) must be less than a total compressive strain of 1.5%, as shown in Fig.10

Density

The most important characteristic is the very low density. Typical densities range from 13.5kg/m^3 to 28kg/m^3 although this can be customised for specific applications. Selecting the correct block density is primarily based on the compressive loads that will be applied during its service life.

Water Absorption

Despite its low density, GEOROCK® will absorb only a limited amount of water. Immersion for a year results in approximately 5% by volume water absorption. Water may also be drawn into blocks by capillary action, but only in very limited quantities. Such levels have no significant effect on the mechanical properties or performance. Where GEOROCK® is likely to be permanently immersed, a design density of 100kg/m^3 should be used by the designer. Conversely, to ensure buoyancy, a design density of no more than 20kg/m^3 should be used.

Dimensional Stability

GEOROCK® block dimensions will not vary by more than 1% from block to block, allowing for easy and precise laying.

Fire Resistance

GEOROCK® contains a fire retardant that restricts the early stages of fire development. If ignited, blocks will self extinguish once the ignition source is removed.

Biological Properties

GEOROCK® won't damage the environment, impact on the water table or affect the chemistry of ground water. Nor will it offer a breeding ground for micro organisms. Blocks will not decay, rot or turn mouldy and any bacteria present in the soil will not attack the EPS.

EPS and the Environment

Extensive international testing shows that GEOROCK® does not degrade into harmful substances, or release any type of contaminant.

EPS plays a positive role as an insulation product in reducing carbon dioxide emissions, and its manufacture does not require the use of CFC's, HCFC's or any ozone depleting gases

Fig.8 COMPRESSION STRESS vs STRAIN

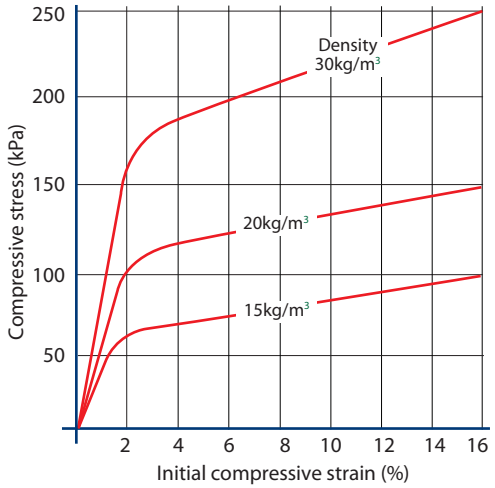


Fig.9 COMPRESSION STRESS vs INITIAL STRAIN

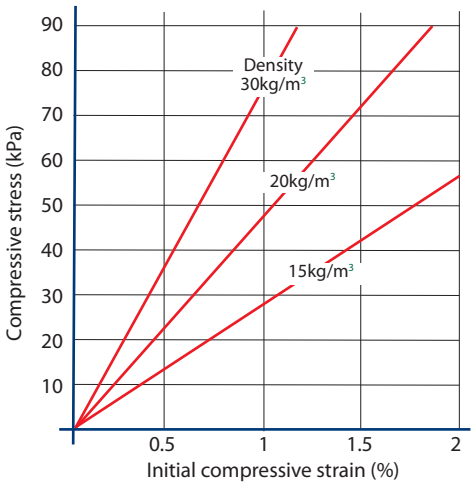
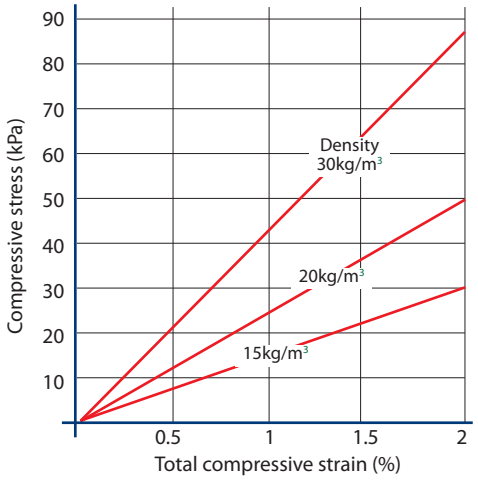


Fig.10 COMPRESSION STRESS vs TOTAL STRAIN



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PROTECTING GEOROCK®

Appropriate protective measures need to be taken to prevent damage to Austral GEOROCK® from harmful substances such as organic solvents, motor fuels and from the possible effects of fire.

Chemical & Fire Resistance

Impermeable geomembranes are used to protect GEOROCK® from the effects of petrol and solvents. Such membranes should have performance properties appropriate for the situation and be installed in strict accordance with the manufacturer's recommendations.

Concrete slabs/walls are recommended to protect the blocks from the harmful effects of fire. Either 150mm thickness of concrete or 1.0m of conventional fill material will provide the equivalent of a four-hour fire resistance.

Fig.11

Chemical Resistance of Georock

Contacting Substance	Effect
Saline solutions, seawater	○
Soap, detergent solutions	○
Bleaching solutions e.g. hydrochlorite, chlorine water, hydrogen peroxide	○
Dilute acids	○
35% Hydrochloric acid 50% nitric acid	○
Fuming sulfuric acid, glacial acetic acid, 100% formic acid	■
Caustic soda or potash solution, strong ammonia	○
Organic solvents e.g. acetone, ethyl, acetate, toluene, xylene, thinners, ethylene	■
Saturated hydrocarbons e.g. white spirits, solvent, petroleum	■
Petroleum jelly, white oil	■
Diesel fuel	■
Gasoline (all grades)	■
Alcohols e.g. Methanol, Ethanol	□
Silicone oils	○

Key:
- ○ No effect, even after prolonged contact
- □ Surface attack or shrinking
- ■ Unresistant, will shrink or dissolve.

CONSTRUCTION

Placing

A bedding layer of sand to a minimum thickness of 50mm is recommended to give GEOROCK® a firm, stable base. Care must be taken to achieve a smooth level base foundation to make placement of subsequent layers easier. Individual layers generally consist of blocks of uniform thickness and size. The orientation of blocks in subsequent layers should alternate so that joints are always staggered. At longitudinal transitions, different layers of blocks are progressively stepped so that GEOROCK® and normal fill gradually overlap – this will minimise the effects of differential settlement.

At the side of embankments, the blocks should be similarly stepped to assist with soil stability. The depth of soil cover on side slopes should never be less than 250mm.

Programming

GEOROCK® can be installed at a rate exceeding 1000m^3 per day, dependant on access and availability of delivery. As each block weighs only 60-120kg, they can be easily handled and moved once on site.

Storage and Handling

As GEOROCK® is a lightweight material, ideally, the material should be placed in its final position as soon as possible after delivery. It should be protected from possible damage and anchored down against wind gusts.

The operation of plant directly on the surface of the blocks needs to be restricted until they are covered with 150mm of fill to avoid permanent deformation of the product. Only lightweight compacting equipment should be used when filling. This also applies to other plant and equipment being used in areas adjacent to the construction site.

MISCELLANEOUS

Consideration should be given by the designer to drainage of the layer above te blocks. For example, a sand layer tapering away transversely from the centre line with a protective membrane laid will assist drainage.

Provision also needs to be made at the periphery for services and fixtures. The thickness of fill above GEOROCK® will also need to accommodate planting and landscaping.

California Bearing Ratio (CBR)

Although subgrade CBR values have been determined for GEOROCK® as a fill material. The behaviour of GEOROCK® can not necessarily be compared to that of a soil subgrade.

In order to give an indication of the CBR values that GEOROCK® can achieve, a limited number of samples have been tested. The results indicate 2% for the lower grades (nominal density 15kg/m^3) and 3% for the higher grades (nominal density 28 kg/m^3).

It is important to understand that GEOROCK® is a material that is designed for specific purposes and has unique characteristics which conventional subgrade/fill materials are unable to offer.

When undertaking design for GEOROCK®, it is recommended that the designer understands the actual pressures transmitted and that the appropriate grades and total construction thicknesses are selected accordingly.

PHYSICAL PROPERTIES OF EPS BLOCK				
Quantity / Unit	Numerical Value			Method
Nominal Density kg / m^3	15	24	28	DIN 53420
Stress kPa - instant strain 10% - final strain 1.5 - 2.0%	 60 - 110 25 - 30	 110 - 160 40 - 50	 200 - 250 70 - 90	DIN 53421
Flexural strength kPa	60 -300	150 - 390	330 - 570	DIN 53423
Shear strength kPa	80 - 130	120 - 170	210 - 260	DIN 53427
Elasticity modulus MPa in compression	1.6 - 5.2	3.4 - 7.0	7.7 - 11.3	DIN 53457
Volume fraction of water 50mm cube immersed 7d	≤7%	≤7%	≤7%	DIN 53433

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CASE STUDIES

These projects have been undertaken in New Zealand by an Austral Comnia Holdings Group company.

Botany Downs Town Centre, New Zealand

Botany Downs Town Centre

GEOROCK® was introduced to the New Zealand market when it was used for a large project at the Botany Downs Town Centre – in this case GEOROCK® was used primarily in the protection of existing underground services (storm water pipe). On this project Tonkin & Taylor Ltd were the geotechnical design engineers, with the main contractor being Mainzeal Construction.

Arthur's Pass SH73 Rock Shelter

The road widening project between Candy's Bend and Starvation Point in the Arthur's Pass region of the Southern Alps was a challenging engineering project. Fulton Hogan Civil were given the task of constructing the rock shelter, using concrete pillars, concrete slabs and GEOROCK®. The GEOROCK® fill is sandwiched between the 'ceiling' slab and the 'roof' slab of the shelter. Its job is to absorb the impact of rockfalls. GEOROCK® had all the right qualities for this job: good strength to weight ratio, elasticity, and prefinished nature allowing quick and easy installation.

Arthur's Pass SH73 Rock Shelter

Glamorgan Drive, Torbay

In order to access a new subdivision at 276-280 Glamorgan Drive, Torbay, on the North Shore of Auckland, a cul-de-sac right-of-way would need to be constructed over a poor load bearing soil. In fact the underlying soil was so unstable, that additional load would certainly result in failure. To alleviate these additional loads, in excess of 350 cubic metres of GEOROCK® were laid as the foundation for the right-of-way, offering both a suitable light weight in the vertical plane, as well as offering almost no lateral loading to the retaining structure constructed to contain this new roadway. This project was designed by McGuigan Syme Chilcott Ltd consulting engineers and site work was carried out by Boss Construction Ltd of Albany.

Glamorgan Drive, Torbay

GEOROCK® is an Austral Insulation registered trade name.

The Bondor NZ equivalent product has the trade name POLYROCK®

Information contained in this flyer is available in PDF format at www.australinsulation.com.au

Harvey Norman Building, Whangarei

Harvey Norman Building, Whangarei

2400m^3 of GEOROCK® used to support the foundation for the concrete slab. GEOROCK® was used to avoid problems associated with Onerahi Chaos soil type, and differential settlement. The lightweight nature, cost effectiveness and strength of GEOROCK® provided a unique lightweight geotechnical fill solution.

ALPURT SH1 Project

The combined effort of W Stevenson & Son Ltd, Connell Wagner and Bondor New Zealand Limited resulted in a new benchmark for roading construction in the future. The ALPURT (Albany to Puhoi Realignment) SH1 A1 Section near Oteha Valley Road has had its share of difficulties - such as time constraints in filling a 30m high earth embankment. Rapid earth filling could have caused embankment failure. GEOROCK® was chosen as the fast and simple solution to increase the safe filling speed and to form the pavement subgrade.

Alpurt SH1 Project

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