



# Reinforcement & Separation

A guide to the design  
and selection of  
ABG Geogrids and  
Geotextiles

**abg** creative  
geosynthetic  
engineering





The need for a sustainable approach to construction and indeed to all human activities has been increasingly recognised over the last few decades. It is now a major criterion in project design. The British government is committed to sustainable construction and a wide range of regulation and guidance has been revised to promote sustainability.

What is less widely recognised is the major contribution that geosynthetics can make to the sustainability of construction and infrastructure works.

Geosynthetics allow the engineering of the performance of marginal materials. By so doing, they minimise the transport of conventional construction materials to site and the transport of poorer, perhaps unusable, materials from site. By structural reinforcement, geosynthetics allow the use of weaker material where historic design approaches might have required extensive, expensive structural works. By allowing drainage of excess water from marginal materials, geosynthetics can allow construction within an acceptable timescale where traditional approaches might have required disposal.

A fundamental of sustainable construction is adequate durability. Geosynthetics have been the subject of a European Life Cycle Assessment. That study has shown that geosynthetics have both adequate life and always have lower environmental impacts - in many cases more than 80% lower - than traditional construction. A study by WRAP in the UK has shown that a geosystems approach is not only environmentally beneficial but also offers lower initial construction cost.

ABG is able to advise on both the engineering suitability of a wide range of geosynthetics in addressing a wide range of engineering challenges and also the environmental impact of those geosynthetics.

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## Ground Conditions

Geosynthetics are used to improve the performance of the ground and therefore a good understanding of the ground is essential. The Technical team at ABG have an outstanding depth of experience of the ground and its interaction with geosynthetics and can advise on all phases of a project from concept to completion.

It is often possible to design for the re-use of site arising soils, thereby avoiding the high costs of haulage, disposal and importation; ABG can assist in identifying such opportunities. Where the use of aggregates cannot be avoided, as for example in the case of construction access roads, the use of geosynthetic reinforcement and drainage may permit a reduced thickness of aggregate or facilitate the use of lower-grade or recycled materials. The need to remove and replace soft subgrade soils may also be reduced. With the use of geosynthetic reinforcement, steeper slopes may be achieved in embankments and landscaping areas and this may assist in reducing disposal costs.

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## Ground Water

The understanding and control of groundwater is fundamental to geotechnical engineering. As geosynthetic drainage experts, ABG has outstanding expertise in the understanding and management of groundwater as an integral part of any engineering solution. Most soils, whether in situ or used as fill materials, will benefit in terms of strength, bearing capacity or CBR from the appropriate use of drainage. ABG geosynthetic drainage products offer high flow capacity, low volume and light weight compared to conventional drainage aggregates. They are generally installable without manual handling issues that may be encountered with some other structural drainage solutions.

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## Material Performance and Specification

As manufacturers as well as suppliers, ABG have an intimate 'hands-on' appreciation of the advantages and limitations of each type of geosynthetic material. The Technical Team will offer this knowledge in support of any geosynthetic design solution, to ensure that the most appropriate materials are specified. In our experience, it is not unusual to find specifications relating to geosynthetics which include parameters that are not particularly relevant to the particular application, omit those parameters that are, or ask for combinations of parameters that are challenging if not impossible within currently available commercial practice. We will be pleased to offer guidance with the drafting of Specifications.

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## Design Codes and Regulations

With over 30 years' experience in the field, we are familiar with both current and past design codes and with conventional practice. ABG personnel are actively involved in the development of codes and standards and we are confident of our ability to offer sound certifiable design advice.

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## Advanced Analysis

ABG also possess advanced commercial software and have calibrated and developed the application of that software to geosynthetic applications. The Technical Team can apply these techniques to challenging design situations if necessary.

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## Sustainability

Recent studies demonstrate the outstanding performance of geosynthetics in sustainable construction. In particular, the reduced carbon footprint of Geosystems is strikingly illustrated in work reported by WRAP, the government's Waste Reduction Action Programme. ABG participated in the study leading to that report and will be pleased to advise on sustainability aspects of geosynthetics.

Geosynthetic reinforcement and drainage products are light in weight and of low volume compared to their mineral alternatives, such as special granular fills and drainage aggregates. The use of geosynthetics can therefore greatly reduce the cost of transportation and the number of vehicle movements required, with consequent environmental benefits due to reduced use of fuel and exhaust emissions as well as conserving scarce aggregate resources for where their use is essential. The incorporation of geosynthetics may also allow the re-use or retention of materials existing on site that would otherwise require off-site disposal.

Geosynthetics for reinforcement, separation and filtration may be used to advantage along with drainage geocomposites in the design and construction of Sustainable Drainage Systems (SUDS), by strengthening open-graded sub-base materials and protecting drainage media from infiltration of fines that will otherwise reduce their effectiveness over time.

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## Design Life

One essential aspect of sustainable construction is the achievement of the intended design life. Premature degradation of performance is anathema to sustainability. The assessment of design life is however a challenging technical issue. ABG have the expertise to support the assessment of design life as great as, and in many cases greater than, "conventional" construction.

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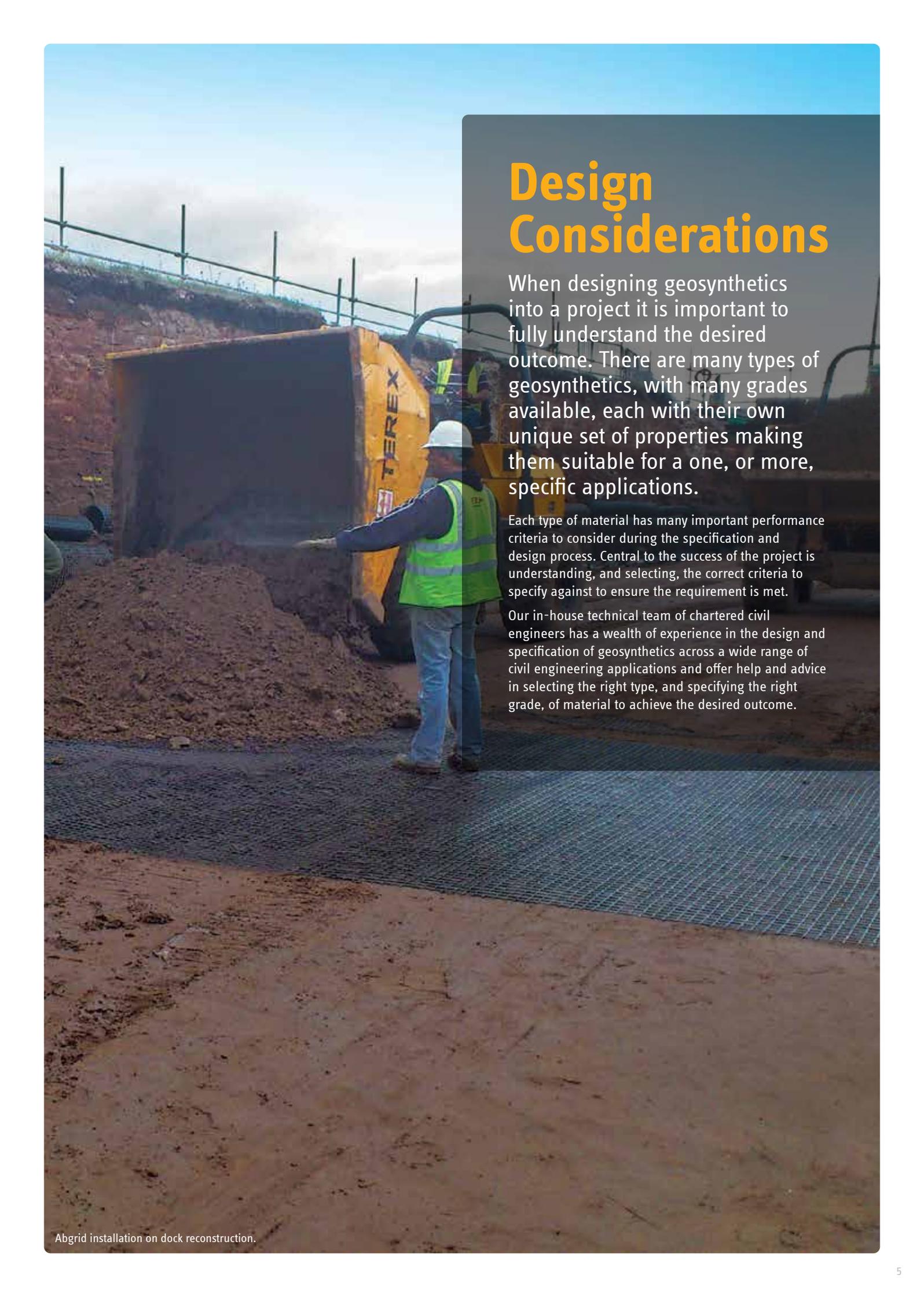
## Software Support

In addition to industry standard design and analysis packages, ABG have developed a complementary suite of in-house software applications to support the design of drainage and reinforcement applications. This allows our Technical team to provide rapid responses to routine design challenges and at the same time gives us the ability to customise our response to novel situations.

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## Product Development

ABG are constantly seeking new or alternative uses for existing products, as well as developing new products and applications. Where possible, we seek to maximise the use of recycled materials and lightweight products in order to minimise haulage costs and handling issues. We are open to suggestions for the use of ABG products in conjunction with existing or new products in the civil engineering and building industries. Our team of Chartered Engineers and polymer technologists are able to appreciate the technical challenges, and our manufacturing capability and close links to major suppliers give us the ability to develop bespoke approaches to individual customer requirements.

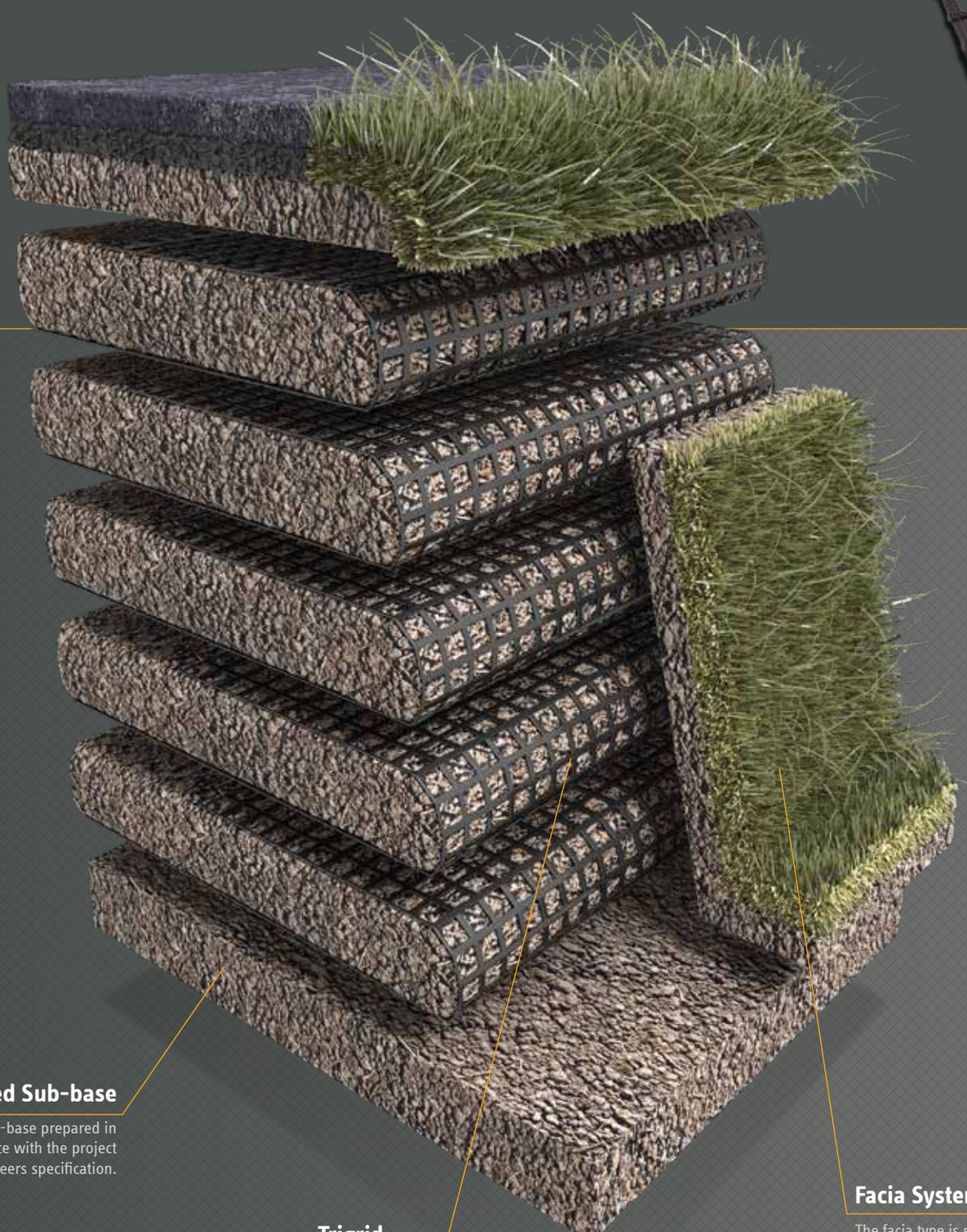


# Design Considerations

When designing geosynthetics into a project it is important to fully understand the desired outcome. There are many types of geosynthetics, with many grades available, each with their own unique set of properties making them suitable for a one, or more, specific applications.

Each type of material has many important performance criteria to consider during the specification and design process. Central to the success of the project is understanding, and selecting, the correct criteria to specify against to ensure the requirement is met.

Our in-house technical team of chartered civil engineers has a wealth of experience in the design and specification of geosynthetics across a wide range of civil engineering applications and offer help and advice in selecting the right type, and specifying the right grade, of material to achieve the desired outcome.



### Prepared Sub-base

In-situ sub-base prepared in accordance with the project engineers specification.

### Trigrid

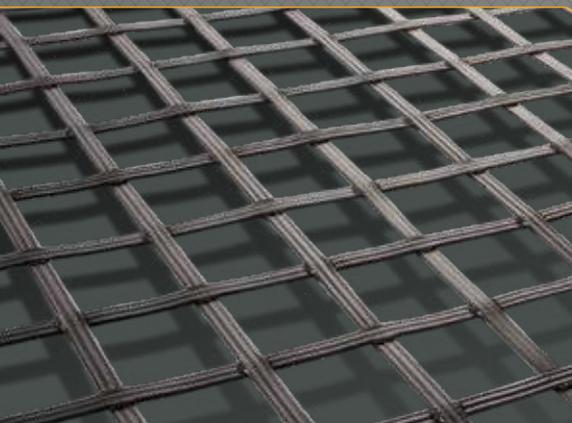
Illustrated here forming a geogrid wrapped steep faced retaining wall, an application where Trigrid's its high strength and long-life performance make it an ideal choice. Trigrid can also be used in many other reinforcement applications.

### Facia System

The facia type is specified according to the specific requirements of the projects. Many facia types can be applied and ABG Technical Department can assist in assessing particular requirements.

# Trigrid EX

Trigrid EX is an innovative geogrid made of fibre-reinforced polymer strips with interlocked structure and welded junctions. It offers excellent creep behavior, high resistance to installation damage and aggressive chemical attack combined with high long-term design strengths.



## Features and Benefits

- High Stiffness with flexural rigidity
- Dimensionally, mechanically, chemically and UV stable
- Excellent creep resistance
- Robust to survive the rigours of installation
- Long term durability

## Typical Applications

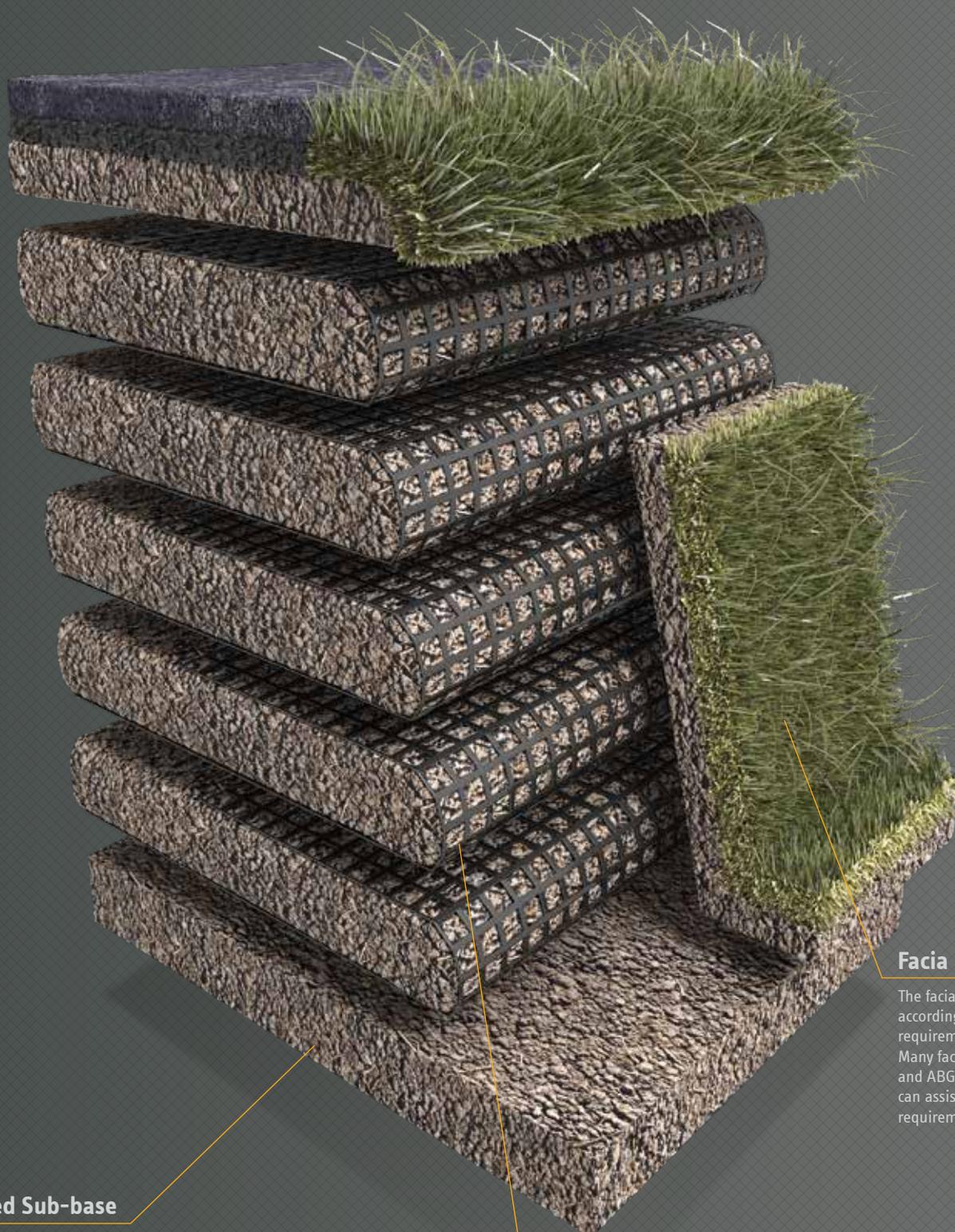
- Soil stabilisation
- Roadway sub-base reinforcement
- Foundation engineering
- Steep slope stabilisation
- Retaining wall reinforcement
- Vegetated retaining walls
- Railway and highway embankments
- Earth bunds
- Landfill veneer reinforcement

The Trigrid EX series is specifically designed for improved performance in soil stabilisation and in both sub-base and soil reinforcement applications. Trigrid EX is dimensionally stable and has a uniform network of apertures that provide significant tensile reinforcement through the whole life of the project.

Trigrid EX is designed to be mechanically and chemically stable to maintain long-term performance both in the arduous construction phase and in aggressive soil environments. It possesses excellent UV protection and is biologically unaffected by soil micro-organisms. The advanced combination of PP and PET materials in the construction of Trigrid EX results in excellent creep, installation damage resistance and high long-term durability.

Property	Unit	EX80/30	EX40/40	EX30/30
Tensile Strength MD	kN/m	80	40	30
Tensile Strength CD	kN/m	30	40	30
Elongation MD/CD	%	9.8	11	11
Force at 2% Elongation	kN/m	21.9	10.0	7.0
Force at 5% Elongation	kN/m	56.3	26	18
Roll Width	m	3.9	3.9	3.9
Roll Length	m	50	50	50

Please contact ABG on 01484 852096 or by email at [geotec@abgltd.com](mailto:geotec@abgltd.com) to discuss your requirements. Data is for indication only. Full datasheet containing test data, methods and tolerances is available on request.



### Prepared Sub-base

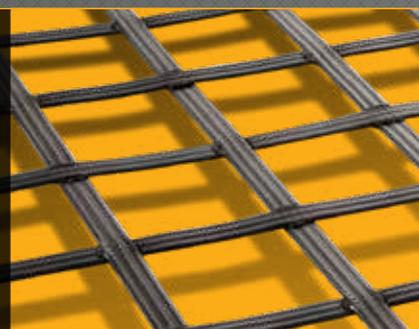
In-situ sub-base prepared in accordance with the project engineers specification.

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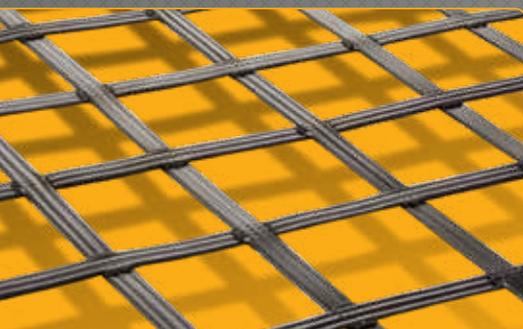
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Elongation MD/CD	%	9.8	11	11
Force at 2% Elongation	kN/m	21.9	10.0	7.0
Force at 5% Elongation	kN/m	56.3	26	18
Roll Width	m	3.9	3.9	3.9
Roll Length	m	50	50	50

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# Abgrid

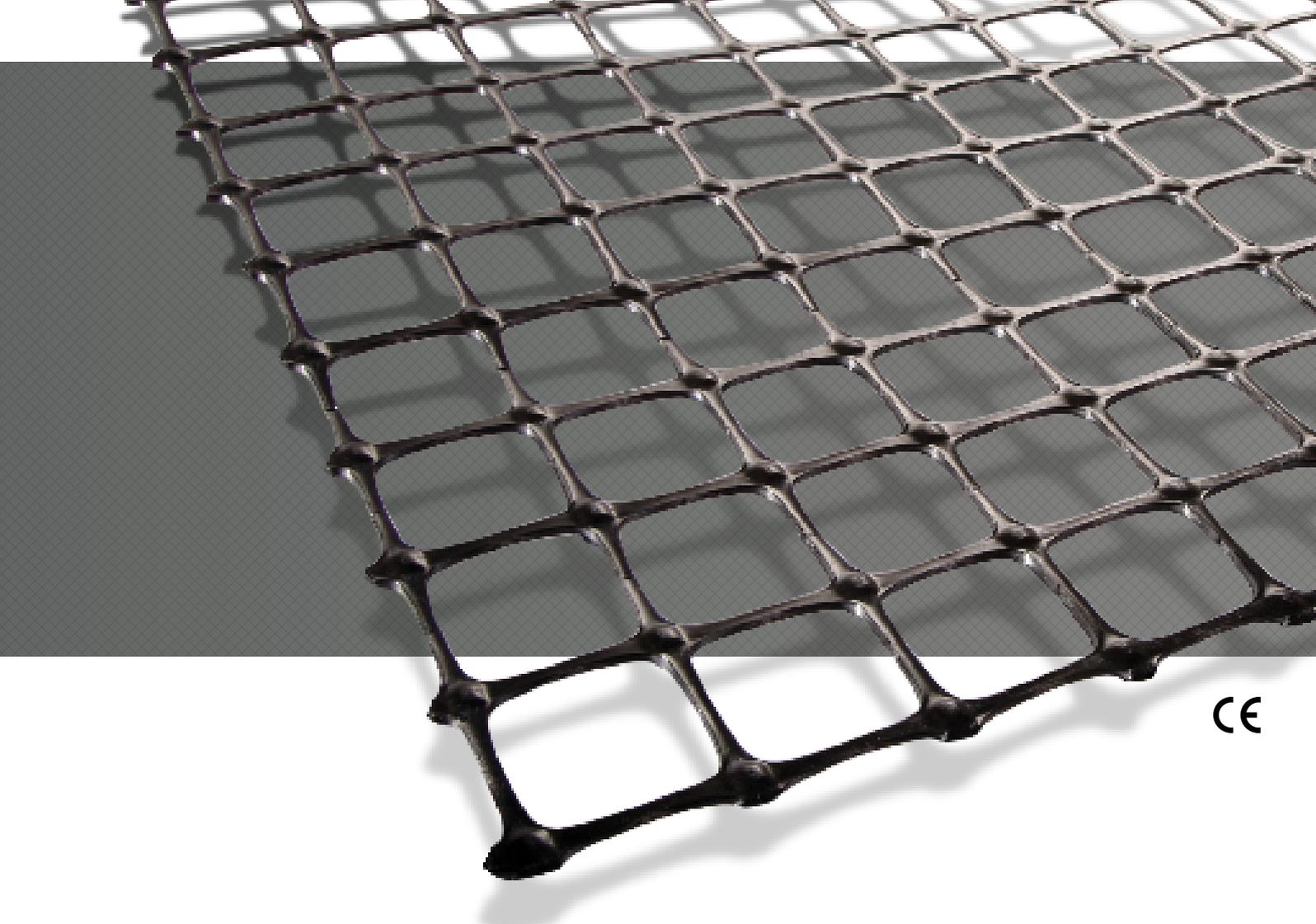
Abgrid is a range of standard grade geogrids for applications in basal reinforcement, ground stabilisation, aggregate reduction, spanning voids, load transfer and foundation engineering. It is manufactured from extruded Polypropylene (PP) which is then punched and then drawn to form a monolithic geogrid with strength in two directions (biaxial).

The combination of ribs and the corresponding nodes allows loads to be transferred through the geogrid structure whilst allowing a positive interlock through the apertures of the reinforced materials. The Abgrid range offers high tensile stiffness at low strains combined with excellent resistance to construction damage and environmental exposure.

Abgrid is both quick and simple to install; its use facilitates a reduction in the required fill thickness, offering savings in material movements on the site. Using Abgrid also improves the resistance to surface rutting which offers savings on the long term maintenance.

Note: When using a geogrid on subgrade with a CBR of less than 3% we recommend including a separation geotextile to prevent fines migration and improve the system performance.





### Features and Benefits

- Cost effective solution
- Proven performance
- Easy Installation
- Robust
- Quality assured

### Typical Applications

- Basal reinforcement
- Unpaved roads and carparks
- Forestry roads
- Temporary works
- Piling platforms
- Shallow reinforced slopes

Property	Unit	20/20	30/30
Colour		Black	Black
Aperture size	mm	39 x 39	40 x 41
Tensile Strength MD/CD	kN/m	20	30
Force at 2% Elongation MD/CD	kN/m	7	11
Force at 5% Elongation MD/CD	kN/m	15	21
Roll Dimension	m	3.95 x 50	3.95 x 50

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# Gridtex

Gridtex is a high performance geotextile engineered for reinforcement and is ideal for strengthening a wide range of soils. It is capable of fulfilling many of the functions of a geogrid whilst at the same time offering all the benefits of a woven geotextile. Gridtex has an extremely high surface friction which interacts fully with adjacent aggregate materials without the necessity for the interlock required with a geogrid.

Reinforcing the aggregate layers allows the use of a thinner construction depth offering cost savings on the project as well as reducing the environmental impact. Gridtex has equivalent capacity at low strain to geogrid products with similar strength grading, however, the increased ultimate tensile strength provides additional security to the construction.

Gridtex is particularly advantageous in construction over soft or fine grained subsoils where it can provide both reinforcement and separation. Gridtex provides cost effective tensile reinforcement for base courses, where the wide roll width is particularly useful for the construction of wide access roads, such as required on windfarm projects.



### Features and Benefits

- Wide width
- High strength
- Low strain
- Reduced construction depth
- Uses less stone
- Separates and reinforces
- Reduced Labour cost.

### Typical Applications

- Soil stabilisation
- Roadway sub-base reinforcement
- Windfarm access roads
- Steep slope stabilisation
- Forestry roads

Property	Unit	Type 1	Type 2	Type 3
Thickness at 2kPa	mm	1.00	1.20	1.30
Mass per unit area	g/m <sup>2</sup>	185	240	356
Tensile Strength MD/CD	kN/m	40 / 40	60 / 60	80 / 80
Elongation MD/CD	%	17.5 / 14	13 / 13	15 / 10
CBR puncture resistance	N	5,000	5,600	9,000
Dynamic perforation cone drop	mm	12	9	9
Characteristic opening size	µm	350	280	230
Water flow normal to the plane	l/m <sup>2</sup> ·s	25	23	10
Roll width	m	5.25	5.25	5.25
Roll length	m	100	100	100

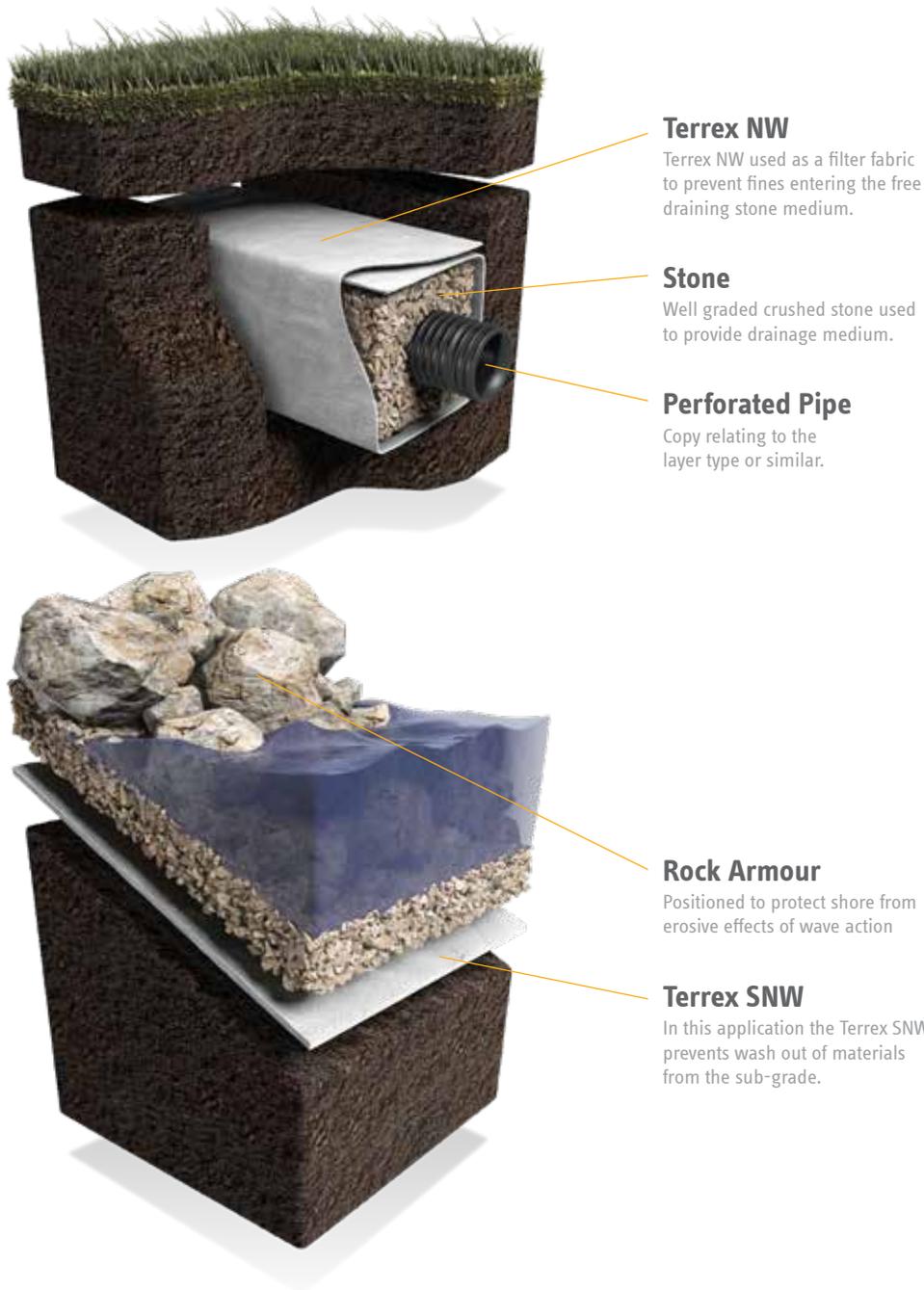
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# Terrex

The Terrex range consists of needle-punched and heat-treated non-woven geotextiles which are designed specifically to offer optimum performance per unit weight in a wide range of applications. The range comprises three different grades of geotextiles suitable for a wide range of separation, reinforcement and protection applications.

**Terrex NW** comprises staple fibre needle punched and heat-treated geotextiles designed to offer optimum performance per unit weight. The resulting mechanical and hydraulic properties make them the ideal choice for straight-forward separation and filtration applications.

**Terrex SNW** offers high performance needle punched polypropylene geotextiles that have been developed to offer outstanding performance at minimum weight. When compared to other needle punched geotextiles of similar weight the SNW shows superior puncture resistance, meaning same performance at greater value.



### NW Features & Benefits

- Uniform tensile strength in all directions.
- Range of CBR puncture strengths.
- Excellent water flow normal to the plane.
- Consistent pore opening size.
- Reduces fill materials.

### Applications

- Separator under site access roads.
- Separation and strengthening under new road.
- Filter medium in french drains.

### SNW Features & Benefits

- High CBR per unit weight.
- High tensile strength with high elongation.
- Combination of fine filtration properties with high water permeabilities.

### Applications

- Filtration.
- Separation.
- Coastal protection.
- Revetment Construction.

Property	Unit	NW8	NW9	NW18	SNW40	SNW80	SNW140
Thickness at 2kPA	mm	1.0	1.1	1.6	2.4	4.4	7.0
Mass per Unit Area	g/m <sup>2</sup>	100	110	210	300	650	1200
Tensile Strength	kN/m	8	9	18	22	46	84
Elongation MD/CD	%	40/45	40/45	50/50	50/55	65/65	84/84
CBR Puncture Resistance	N	1400	1500	3000	4000	8000	14000
Dynamic Perf Cone Drop	mm	34	30	16	12	4	0
Pore Size O <sub>90</sub>	µm	130	120	80	70	63	49
Waterflow Normal to Plane	l/m <sup>2</sup> -s	110	110	85	75	30	25
Roll Width	m	5.25	5.25	5.25	5.25	5.25	5.25
Roll Length	m	100	100	100	100	55	35

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# Abtex SG

Abtex SG offers a range of woven geotextiles from lightweight fabrics for basic separation functions through to high strength products offering cost effective reinforcement in civil engineering projects.

The range has a wide range of tensile strengths that ensures there is an SG grade to meet most performance requirements.

Abtex SG is typically used as a general purpose separator for use under site access roads and areas of hardstanding but also has uses in separation and strengthening layer under new roadways, car parks, industrial units etc., erosion control layers and for general separation applications.

Abtex SG Woven Geotextiles are manufactured from highly durable polypropylene polymer and have a long life cycle when used in permanent structures. Which grade of Abtex is required is dependent on a number of factors including aggregate size and the on-site soil conditions, our experienced in-house department can help you ensure the right grade is selected.



## Crushed Stone

Well graded crushed stone. Exact specification will depend on project requirements and local availability. Stone is laid directly onto Abtex SG.

## Abtex SG

Abtex laid directly onto prepared sub-grade. Grade required is a function of sub-grade conditions and stone grade. ABG Technical Department can advise on suitable grade.

## Sub-grade

Prepared in accordance with project engineers requirements and with installation guide.

### Features and Benefits

- Easy installation
- High strength
- Cost effective
- Reduces environmental impact

### Typical Applications

- Separating sub-base layers
- Reinforcement of unpaved roads, work platforms and slopes
- Slope protection
- Temporary Works
- Construction of embankments over weak soils

Property	Unit	18/9	20/20	30/30
Mass per unit area	g/m <sup>2</sup>	65	84	121
Thickness	mm	0.20	0.32	0.55
Tensile Strength MD/CD	kN/m	16	21	30
Elongation MD	kN/m	22	22	20
Elongation CD	kN/m	13	12	11
CBR Puncture Resistance	N	1800	1960	3000
Dynamic Perf Cone Drop	mm	24	16	19
Pore Size O <sub>90</sub>	µm	300	200	540
Water flow normal to plane	l/m <sup>2</sup> ·s	30	13	35
Roll Width	m	4.5	5.25	5.25
Roll Length	m	100	100	100

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# Abweb

Abweb is a three dimensional cellular matrix designed to strengthen weak soils in horizontal applications such as access roads, car parking areas and site compounds. It strengthens and reinforces granular stone layers such as sub-base by confining the aggregate within a three dimensional tensile matrix.

Using Abweb offers an inexpensive system with which it is possible to reduce the thickness of aggregate under loaded areas by up to 50%. This reduces the volume of aggregate required and also reduces the volume of excavation thereby reducing lorry loads to and from the site helping minimize the impact on the environment of the project.

Abweb provides reinforcement of granular stone layers in all civil engineering applications, particularly beneath permanent or temporary roads and tracks. It is especially useful where site access is restricted or availability of good quality crushed stone is limited.





### Features and benefits

- Easy to install
- Uses site won materials
- Reduces imported stone requirements
- Mitigates impact on the environment

### Applications

- Sub-base Reinforcement
- Access/Haul Roads
- Site Compounds
- Piling Platforms
- Tree Root Protection

Property	Unit	200/300	150/250
Cell Depth	mm	200	150
Cell Opening	mm	300	250
Wall Thickness	mm	1.2	1.2
Seam Tensile Strength	N	2400	1800
Material		HDPE	HDPE
Colour		Black	Black
UV Stability		Excellent	Excellent
Standard Pin Length	mm	500	500
Life Expectancy	Years	>120	>120

Note: On weak ground with CBR of less than 3% a Terrex NW geotextile is required below the Abweb to prevent migration of fines.

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## Erosion Control

These products cover a broad section of erosion control requirements including biodegradable or non-biodegradable and pre-seeded varieties. ABG erosion control products can help with both the surface protection and the structural stability of soil slopes.

Silt laden run-off from exposed soil slopes is a major concern for the Environment Agency (EA) who consider it to be a pollutant; ABG erosion control products help ensure that the slope is protected from through construction to the final vegetation being established.

As with all ABG products, design advice on which materials are best for your individual application and their specification is available from our experienced technical department.



Installing Erosaweb for top-soil retention on steep embankment.

## Retaining Walls

ABG became involved in designing retaining walls through reinforced earth over twenty years ago when with the development of a range of ground engineering solutions.

This included Webwall, ABG's own cellular retaining wall system developed as a sustainable green wall solution.

As the number of Webwall projects grows in both number and physical size so does internal knowledge on utilising the system. Today ABG are in position to offer full PI covered design, material specification and supply, including advice and specification of the drainage works and then, through carefully selected partner businesses, the installation of the Webwall right through to planting the face with the right plants for your project environment.



Webwall used to form vegetated retaining wall.

## Structural Drainage

ABG have vast experience in drainage solutions supplying projects globally across a wide range of sectors including infrastructure, energy, water, waste and many other sub-surface structures.

Using preformed drainage systems ABG offer sub-surface drainage with higher performance, lower environmental impact and lower cost than traditional granular filters. ABG systems have been specifically designed to be compatible with waterproofing systems whilst withstanding the high loads associated with backfilling to give optimum performance over the whole life of the structure.



Deckdrain installed as structural drainage on bridge structure.

## Findrains

ABG fin drains (Fildrain) offer a high performance, economic alternative to traditional stone groundwater drainage solutions and are used extensively in a wide range of applications from highway edge drainage through to landscape drainage. Fildrain also has applications in the drainage of embankments and reinforced earth structures, cut-off trenches on contaminated land and landscape applications where a narrow trench is dug and the Fildrain placed within and backfilled using excavated materials. Fildrain offers a viable cost-effective to traditional drainage systems formed using geotextile filter fabrics and stone drainage medium.



Fildrain installed as highway edge drainage.



## About ABG

ABG are a market leader in the development, manufacture and technical support of high performance geosynthetic solutions for use in a wide range of building and environmental projects.

Formed in 1988, based in Meltham, in the heart of the Pennines, ABG has developed an excellent reputation for developing quality products and outstanding service. The ability for rapid product development ensures that the most innovative, up to date and cost effective solution can be found for many civil engineering problems including basal and subbase reinforcement, reinforced earth structures and drainage.

Our involvement in civil engineering applications goes back over twenty years and we now have a complete range products developed specifically for this sector.

Through this period we have supplied products to projects throughout the world including over 50,000,000m<sup>2</sup> of geosynthetics into civil engineering applications. Technical support is provided by our trained and experienced staff, many of whom are Chartered Civil Engineers. This extensive support includes design, design confirmation, feasibility study, cost advice and meeting regulatory requirements.

As part of this technical support much work is undertaken in developing knowledge within our active markets including working with organisations such as the Environment Agency.

## Further Reading

Designing with Geosynthetics, Koerner R.M, Prentice Hall  
Geotextiles and Geomembranes Manual, Ingold T.S, Elsevier

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geosynthetic  
engineering

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