ENVIRONMENTAL SYSTEMS

soil stabilization, reinforcement, drainage, superficial erosion control

TeMa Technologies and Materials

HIGH BUILDING PROTECTION

04 B P : 0526 Cotonou
contact@hbpbenin.com
www.hbpbenin.com
Tél: (+229) 21 33 33 48
Cél: (+229) 95 96 00 08

HBP HIGH BUILDING PROTECTION

Ideas and solutions for construction with geosynthetics

With the experience that comes from being an international industry leader the **TeMa** Group has quickly distinguished itself with the introduction of new technology, new materials and a highly advanced manufacturing system and operations in Italy, Spain, Turkey and Russia.
With a presence in more than 60 countries **TeMa** is a major participant in the geosynthetics market, with a special department supporting designers and businesses in the industry.

TeMa: *ideas and solutions for construction with geosynthetics.*

The goal of **TeMa's Environmental Division,** through continuous new product research, is to encourage the active involvement of designers and businesses and provide support to clients in the product pre-sale stage as well as during and after installation.
TeMa's quality control laboratory, specialised technical support department and sales and distribution network work together, turning every market requirement into a goal to be achieved effectively and promptly. The worldwide sales network ensures the rapid circulation of information and allows different ways of solving geosynthetics issues to be compared. This means **TeMa** can always propose the most appropriate solution.

Index

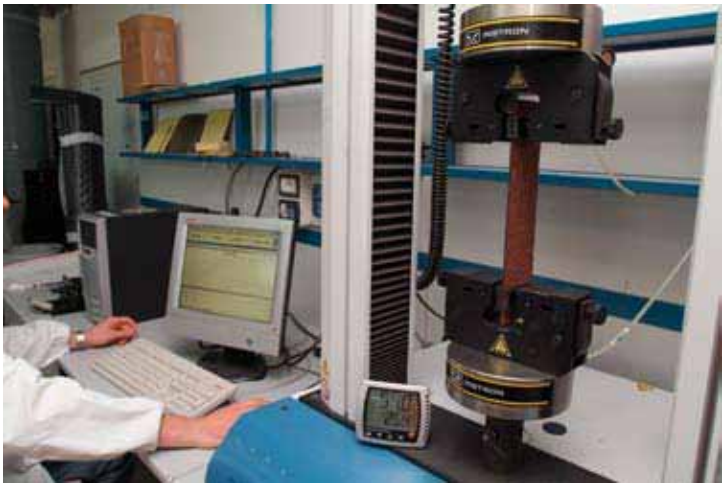
Commercial structure

Continuous testing in the most demanding international markets provides the impetus for **TeMa** to continuously improve its products and services. Sharing experiences, in-house staff training and upgrading of the skills of partners are the basis for a strongly customer-focused professional development process aimed at meeting needs and making choices based on solutions to specific issues.

- **Sales Network**
- **Regional Agencies run by Trained Professionals**
- **Technical and Commercial departments supporting agents**
- **Internal Customer Service and Logistics**
- **Meeting and Seminar-Based Training and Information**
- **Continuous Research for New Solutions through International Partnerships**
- **Innovation driven**

Research, Development and Quality Certification

Technical Department



TeMa 's in-house Technical Department provides support to clients, from help with choosing solutions to the practicalities of on-site installation. Using in-depth analysis and leading edge software **TeMa** engineers are able to recommend appropriate comprehensive, reliable solutions to clients for any kind of project involving geosynthetic products. Dimensional analysis, structural checks and recommended product specifications are essential support for designers and new businesses, as well as for established industry operators who wish to further develop their expertise in a field that is continuously evolving, and offer versatile, modern solutions. The nature of the project is assessed by examining all the necessary parameters, and tailoring and specifying outcomes for every single component.

- **Site Inspections**
- **Project Assessment**
- **Technical Report preparation**
- **Preparation of Specifications**
- **Recommendations**
- **Agent Technical Support**

Laboratory

Since its establishment **TeMa** has always believed that the key to success is a commitment to researching and developing new solutions. In the field of geosynthetics in particular, cooperation between the Technical Department and the testing and quality control Laboratory is crucial because it offers clients the very latest products and also because it supports designers and businesses in the proper application of proposed solutions. Tests for durability, resistance to compression and drainage capacity in critical situations are just some of the tests carried out every day by **TeMa's** laboratory to ensure its products meet the toughest quality standards. Through this continuous striving for excellence **TeMa** has been granted UNI EN ISO 9001:2000 quality certification, ensuring that all its products perform to the highest level. With CPD (Construction Product Directive) 89/106/CEE, the range of **TeMa** products has satisfied the requirements for CE labelling.

Every production aspect is monitored and continuously improved: from actual production to pre- and post-sale support as well as the distribution network and delivery to clients. The scrutiny of the top external laboratories provides the drive for continuous improvement in the testing and checking procedures carried out during the various stages of production.

- **Raw Material Tests**
- **Research and Development Support**
- **Finished Product and Prototype Quality and Performance Tests**
- **Product Data Sheet drafting and updating**
- **Quality Control**
- **Certification**
- **Supervision and Monitoring of Production Processes**
- **Sample testing of product lots and conformity checking**


ZERTIFIKAT SKZ

Certificate of Factory Production Control
1213-CPD-4006

Q DRAIN ZM 8 14P, T-MIX DRAIN PLUS, Q DRAIN ZM 8 40 14P

Q DRAIN ZM 8 TG 14P, Q DRAIN ZM 8 40 TG 14P

Q DRAIN ZM 8 14P, Q DRAIN ZM 8 150P,
Q DRAIN ZM 8 TS 14P, Q DRAIN ZM 8 TS 150P

Q DRAIN ZM 8 TG 14P

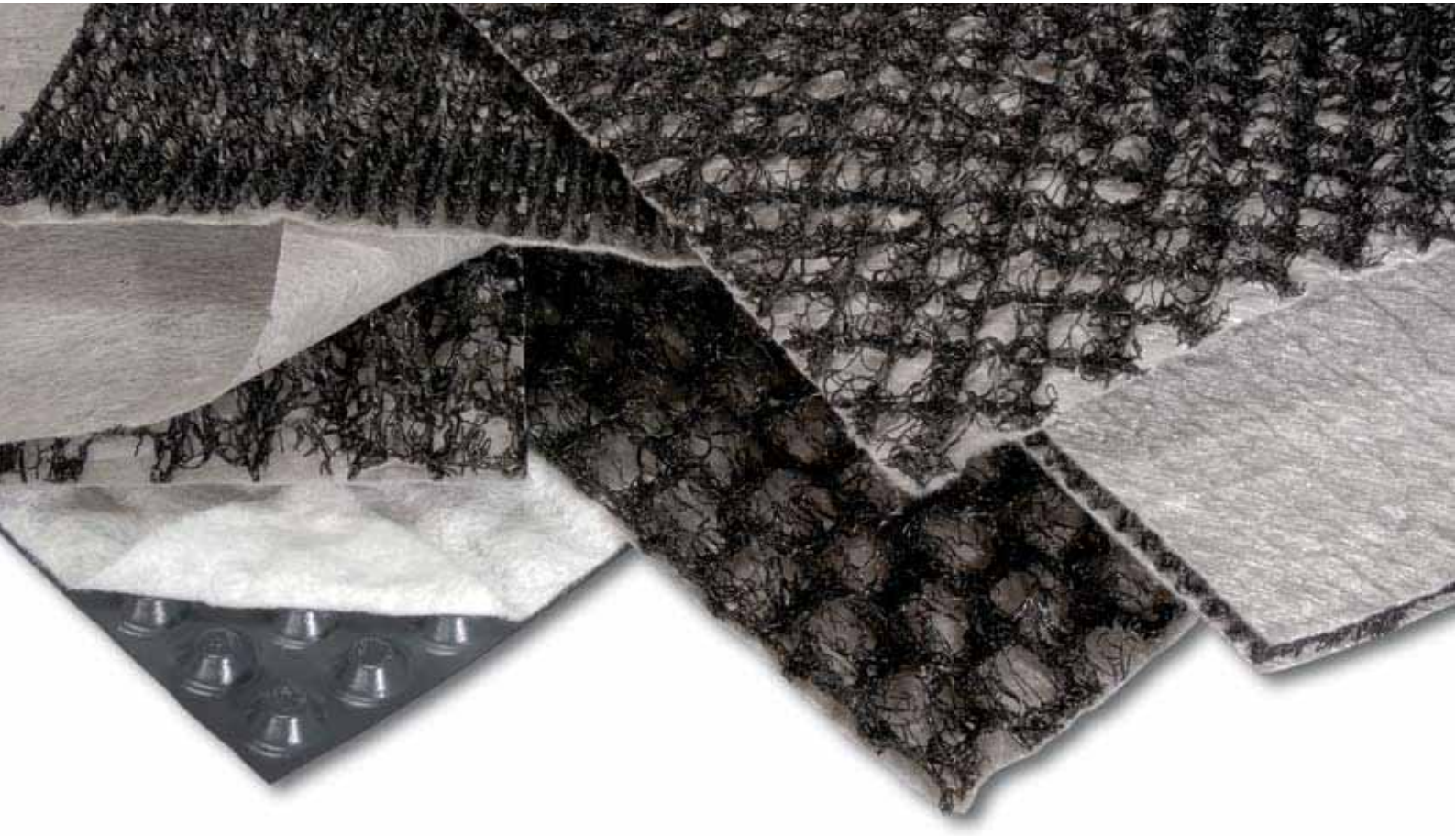
TEMA Technologies and Materials S.r.l.

Vittorio Veneto

DIN EN 13252:2000

SKZ

CE



Drainage geocomposites

In designing any structure the issues involved in the control and management of soil water circulation are undoubtedly one of the major risks that a designer has to tackle. In most cases a surrounding drainage solution will be needed to ensure the functionality and the stability of the project. With the advent of geosynthetic materials nowadays it is possible to appropriately control the presence of water ensuring a higher degree of security. Suitable geosynthetic products (drainage geocomposites - DGCs) are several centimetres thick and made by joining filter and separation elements (non-woven geotextiles) to an internal three-dimensional structure. This structure can be made of extruded polypropylene filaments or thermoformed high-density polyethylene sheets (HDPE).
All drainage geocomposites shown on these pages are CE approved in accordance with the UNI EN 13252:2005 harmonized standard.

QDrain

QDrain is a drainage geocomposite obtained by joining a polypropylene monofilament drainage core with one or two non-woven fabrics also of polypropylene. Thicknesses vary from a minimum of 8 mm up to 20 mm.

SpeeDrain

SpeeDrain is a drainage geocomposite with an internal structure similar to QDrain, but specially designed for trench drainage.

Isostud Geo P

Isostud Geo P on the other hand is a DGC, made by joining a thermoformed HDPE sheet to a filtering geotextile.

Maxistud

Maxistud is a very thick (20 mm) exceptionally resistant thermoformed HDPE sheet.

TeMa
Technologies and Materials

Applications

The main DGC applications are shown in the table and grouped by placement angle. Uses range from residential building to complex civil engineering infrastructures.

Pressure (kPa)	Laying angle: Horizontal (i=0,03)		Oblique (i=0,32)		Vertical (i=1)	
0 / 20	Hanging garden	**QDrain C Isostud Geo P**	Rubbish tip	**QDrain C**	Trench Foundation wall Retaining wall Reinforced earthworks	**QDrain C SpeeDrain Isostud Geo P**
20 / 50	Rubbish tip (capping) Earthen structure	**QDrain C QDrain Z**	Rubbish tip Tunnel	**QDrain C QDrain Z Maxistud**	Foundation wall Tunnel Trench Reinforced earthworks	**QDrain C SpeeDrain Isostud Geo P**
> 100	Rubbish tip (bottom) Earthen structure Tunnel	**QDrain Z Isostud Geo P Maxistud**	Rubbish tip (bottom)	**QDrain Z**	Reinforced earthworks	**QDrain Z**

Product	Geotex-tiles	Section	Thickness (mm)	Mass (g/m²)	Drainage low loads	Drainage high loads
QDrain C 20 P	2		20	930	****	**
QDrain C 20 50 14P	2		20	780	****	**
QDrain C 20 P TG	1		23	790	****	**
QDrain C 15 P	2		15	930	***	**
QDrain C 15 P TG	1		16	790	***	**
QDrain ZW 8 14P	2		8	780	**	****
QDrain ZW 8 14P TG	1		8	640	**	****
QDrain ZM 8 14P	2		8	780	**	****
QDrain ZM 8 40 14P	2		8	680	**	****
QDrain ZM 8 14P TG	1		8	640	**	****
QDrain ZM 8 40 14P TG	1		8	540	**	****
SpeeDrain C 20 B 14P	2		20	930	***	**
SpeeDrain ZM 8 B 14P	2		8	780	**	****
SpeeDrain ZM 8 OSWP	2(*)		8	780	**	****
Isostud Geo P	1		7,5	610	***	*
Maxistud	-		20	1000	**	****

*) One side filter and the other equipped with a waterproof polyolefin sheath

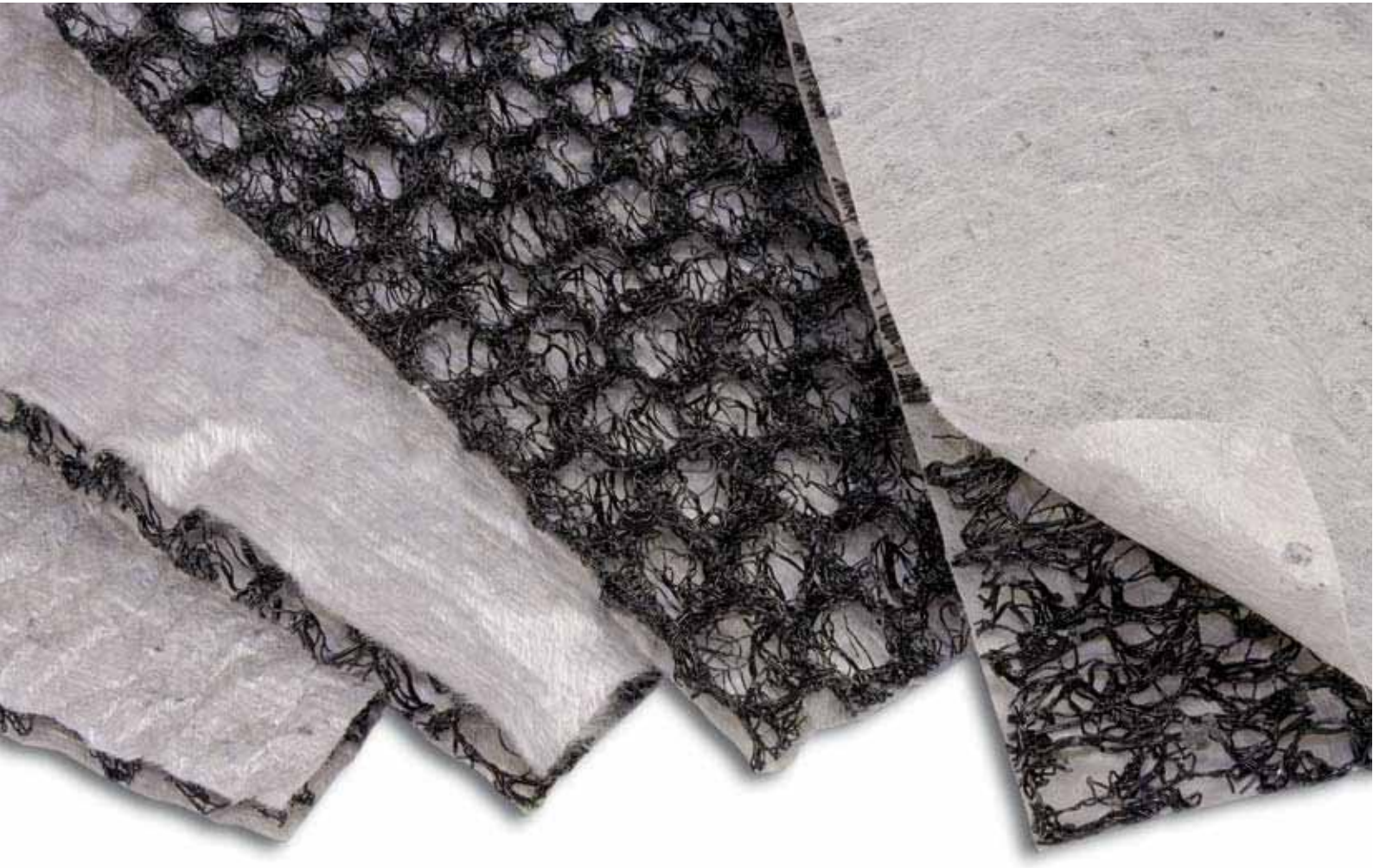
Protection of waterproofing and drainage in a shopping centre foundation

Landfill capping using QDrain ZW 8 14P

Extrados drainage of a man-made tunnel using QDrain C 20P

Drainage geocomposites

Biogas capture system in a solid urban waste landfill



QDrain C

Structure

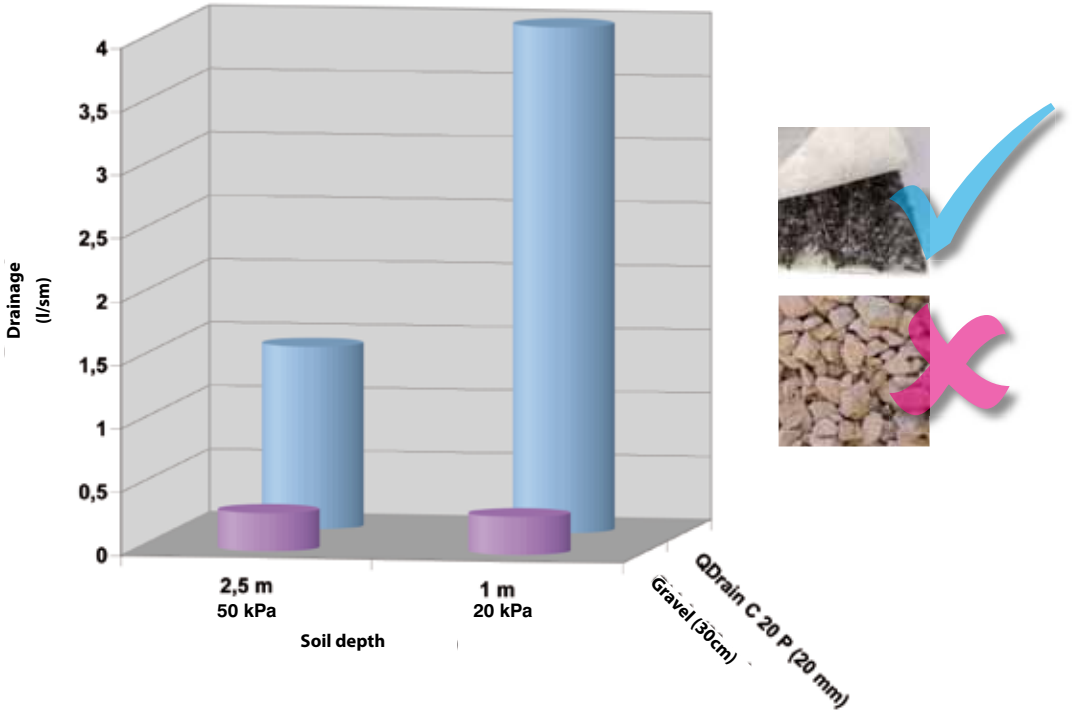
A drainage geocomposite consisting of a cusp-shaped internal core, with a high void ratio, made from extruded synthetic propylene monofilaments tangled and welded where they cross, with two non-woven geotextiles attached thermally. These are designed to filter water, preventing soil particles from clogging the internal core which collects and removes captured water, keeping the product flexible and adaptable to any surface.
QDrain C varies in thickness between 15 and 20 mm and is available in a **GT** version, with one geotextile instead of two.

Applications

The main applications of **QDrain C** are those where drainage capacity needs to be maximised. As a matter of fact, this product guarantees very high performance, with loads up to 50 kPa.
This makes it the ideal building industry solution for terraced gardens and for draining foundation walls, as well as in civil and environmental engineering projects. **QDrain C** can be used when building rubbish tips (including cappings), tunnels, road and railway embankments and drainage systems in reinforced earthworks.

TeMa Technologies and Materials

Gravel drainage vs. QDrain



The graph shows **QDrain C'**s superior drainage performance compared to gravel. With a thickness of just 20 mm (compared to 30 cm for gravel) **QDrain C** delivers 5-13 times better drainage, depending on soil pressure.

Application	Pressure	QDrain C 20P	QDrain C 20 50 14P	QDrain C 20P TG	QDrain C 15 P	QDrain C 15 P TG
Horizontal (i=0,04)	20 kPa	1,15	0,70	0,59	0,55	0,28
	50 kPa	0,23	0,13	0,61	0,13	0,51
	100 kPa	0,05	0,03	0,19	0,07	0,17
Oblique (i=0,10)	20 kPa	1,21	1,10	1,96	0,90	1,46
	50 kPa	0,36	0,22	0,78	0,22	0,74
	100 kPa	0,09	0,07	0,25	0,10	0,21
Vertical (i=1)	20 kPa	3,99	3,30	5,67	2,20	4,93
	50 kPa	1,44	0,82	2,36	0,80	2,25
	100 kPa	0,39	0,27	0,80	0,40	0,60

In-plane hydraulic properties (l/sm) of the drainage geocomposite measured with Soft/Rigid contact according to EN ISO 12958

QDrain Z

Structure

A drainage geocomposite consisting of an internal core with a high void ratio, made from extruded synthetic propylene monofilaments zig-zagged and welded where they cross, with one or two non-woven geotextiles thermally attached. These are designed to filter water, preventing soil particles from clogging the internal core which collects and removes captured water, keeping the product flexible and adaptable to any surface.

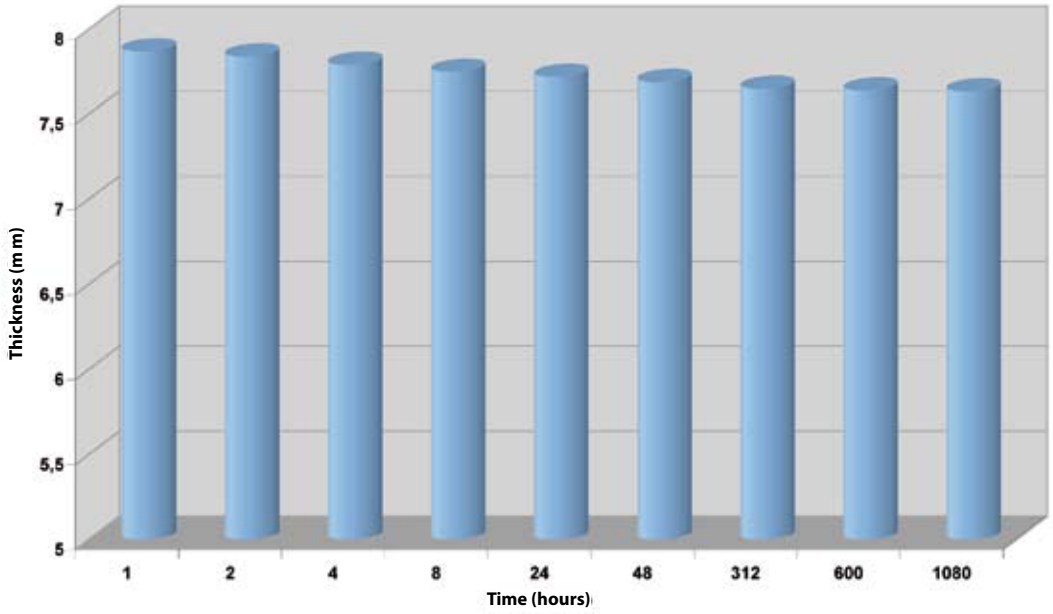
QDrain Z is 8 mm thick and is also available in the **W** version, with channels arranged parallel to the length, and **M,** with perpendicular channels.

Applications

The main applications of **QDrain Z** are when a high degree of drainage is required in situations where load exceeds 100 kpa.

This makes it the ideal solution for civil and environmental engineering projects. **QDrain Z** can be used when building rubbish tips (including landfill bottoms), tunnels, road and railway embankments and drainage systems in reinforced earthworks where its strength is designed to cope with the high loads.

Residual thickness of QDrain ZW at 200 kPa



The graph shows the ability of **QDrain Z** to retain its thickness - and therefore its drainage capacity - practically unaltered even under very high loads. This makes **QDrain Z** the best solution wherever there is high confinement pressure.

Application	Pressure	QDrain ZM 8 14P	QDrain ZM 8 40 14P	QDrain ZM 8 14P TG	QDrain ZM 8 40 14P TG	QDrain ZW 8 14P	QDrain ZW 8 14P TG
Horizontal (i=0,04)	50 kPa	0,33	0,39	0,32	0,49	0,30	0,52
	100 kPa	0,30	0,32	0,22	0,39	0,27	-
	200 kPa	0,13	0,09	0,13	0,10	0,02	0,10
Oblique (i=0,10)	50 kPa	0,50	0,75	0,54	0,91	0,49	-
	100 kPa	0,40	0,50	0,38	0,65	0,43	-
	200 kPa	0,14	0,15	0,22	0,18	0,03	-
Vertical (i=1)	50 kPa	2,00	2,16	1,96	2,73	1,76	3,16
	100 kPa	1,60	1,80	1,45	2,17	1,41	-
	200 kPa	0,60	0,54	0,84	0.64	0,17	0,60

In-plane hydraulic properties (l/sm) of the drainage geocomposite measured with Soft/Rigid contact according to EN ISO 12958

SpeeDrain

Structure

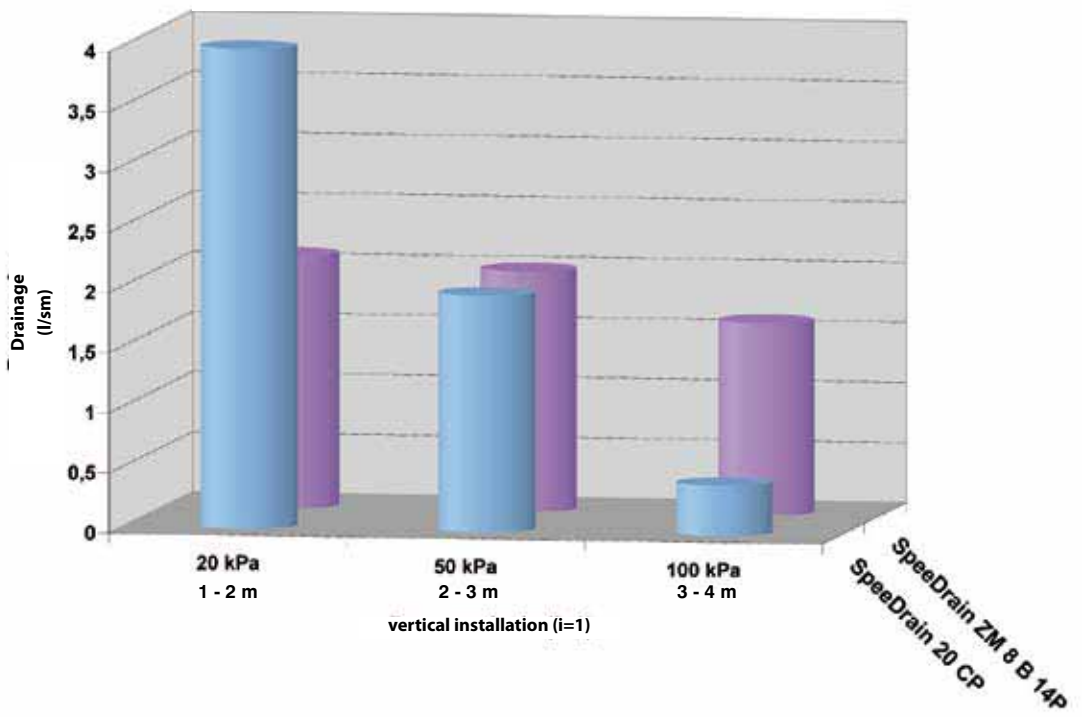
A drainage geocomposite consisting of a high void ratio internal core, made from extruded synthetic propylene monofilaments tangled and welded where they cross, with two nonwoven filtering geotextiles attached thermally, designed to filter water.
A slotted pipe may be attached to **SpeeDrain** (available in 20 mm and 8 mm thicknesses) to collect drainage water and carry it to the desired location.
In the **SpeeDrain OSWP** version one of the two geotextiles is replaced by an impermeable polyolefin membrane.

Applications

Main applications for **SpeeDrain** are where there is a need for vertical drainage. Its high drainage capacity and its suitability for connecting to a water discharge pipe make it the ideal solution for the construction of drainage trenches, retaining walls, reinforced earthworks and surface stabilisation on unstable slopes.

TeMa
Technologies and Materials

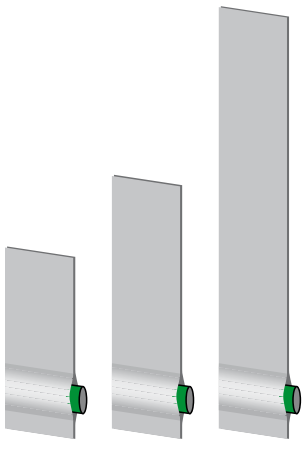
TRENCH DRAINAGE WITH SPEEDRAIN



The graph shows the different characteristics of the two kinds of **SpeeDrain** made by **TeMa**. While both are designed for vertical drainage applications, they differ in their drainage capacity under different pressures. While **SpeeDrain C 20P** ensures maximum performance under "light" loads, **SpeeDrain ZM 8 B 14P** guarantees best performance when subjected to loads exceeding 50 kPa.

Application	Pressure	SpeeDrain C 20P	SpeeDrain ZM 8 B 14P	SpeeDrain ZM 8 OSWP
Horizontal (i=0,04)	20 kPa	0,77	0,36	0,36
	50 kPa	0,49	0,33	0,33
	100 kPa	0,09	0,30	0,30
Oblique (i=0,10)	20 kPa	1,20	0,60	0,60
	50 kPa	0,61	0,50	0,50
	100 kPa	0,12	0,40	0,40
Vertical (i=1)	20 kPa	3,99	2,10	2,10
	50 kPa	1,97	2,00	2,00
	100 kPa	0,42	1,60	1,60

In-plane hydraulic properties (l/sm) of the drainage geocomposite measured with Soft/Rigid contact according to EN ISO 12958



1,40 m 2,10 m 4,10 m

SpeeDrain is available in different lengths to suit the depth of the trench

Isostud Geo P

Structure

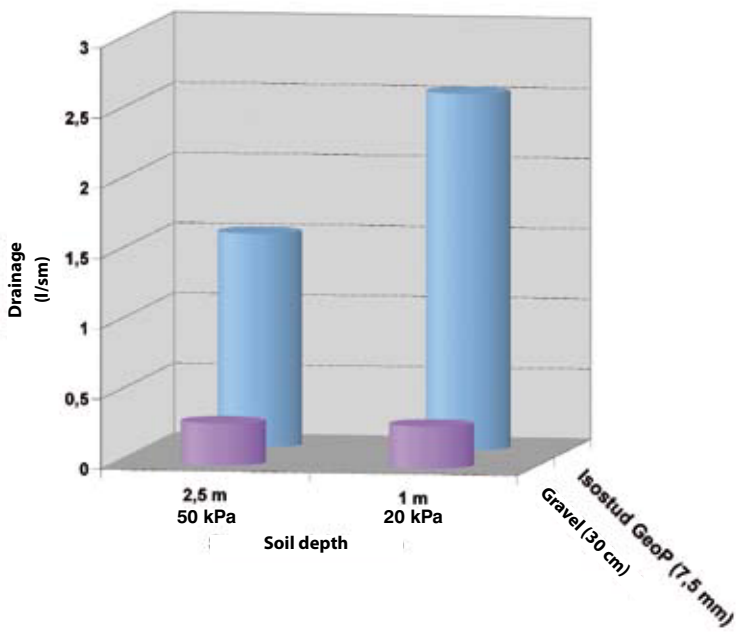
A drainage geocomposite consisting of a thermoformed HDPE sheet, joined to a non-woven filtering geotextile. The special truncated cone shape of the studs makes **Isostud Geo P** - within the limits of its field of application - particularly resistant to crushing without losing its hydraulic qualities. Although rolls can be laid side by side and easily overlapped by slotting the studs into each other, **TeMa** has developed a production line which makes rolls up to 4.8 metres wide so that **Isostud Geo P** can be laid horizontally with a minimum of overlapping.

Applications

The main applications of **Isostud Geo P** are in situations where a good level of drainage is required under medium-high pressure. This product guarantees good, stable performance with loads from 10 to 50 kpa.
Non-intensively cultivated terraced gardens are one example of a horizontal application where **Isostud Geo P**'s qualities are especially desirable.
For vertical applications **Isostud Geo P** is recommended for the protection and drainage of foundations and retaining walls. In this case the option of horizontal laying is an added benefit.

TeMa
Technologies and Materials

Drainage gravel vs. Isostud Geo P



The graph shows **Isostud Geo P‘**s superior drainage performance compared to gravel. With a thickness of just 7,5 mm (compared to 30 cm for gravel) **Isostud Geo P** provides drainage from 5 to 8 times better, depending on soil pressure.

Mechanical protection and drainage of a retaining wall using **Isostud Geo P**.

Application	Pressure	Isostud Geo P
Horizontal (i=0,04)	20 kPa	0,34
	50 kPa	0,22
	100 kPa	0,08
Oblique (i=0,10)	20 kPa	0,61
	50 kPa	0,33
	100 kPa	0,11
Vertical (i=1)	20 kPa	2,54
	50 kPa	1,52
	100 kPa	0,44

In-plane hydraulic properties (l/sm) of the drainage geocomposite measured with Soft/Rigid contact according to EN ISO 12958

Maxistud

Structure

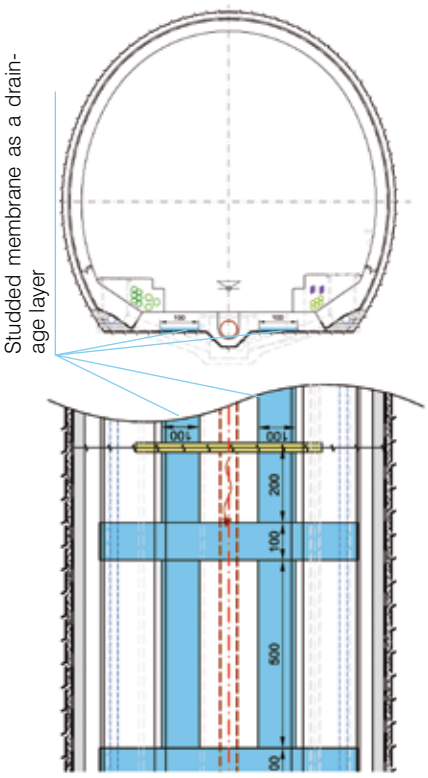
Maxistud is a studded membrane made by thermoforming a high density polyethylene film. The overall thickness of the finished product and the number of studs per square metre are specially designed to optimise resistance to compression, maximising air volume to ensure the best performance even in the most demanding situations.

Applications

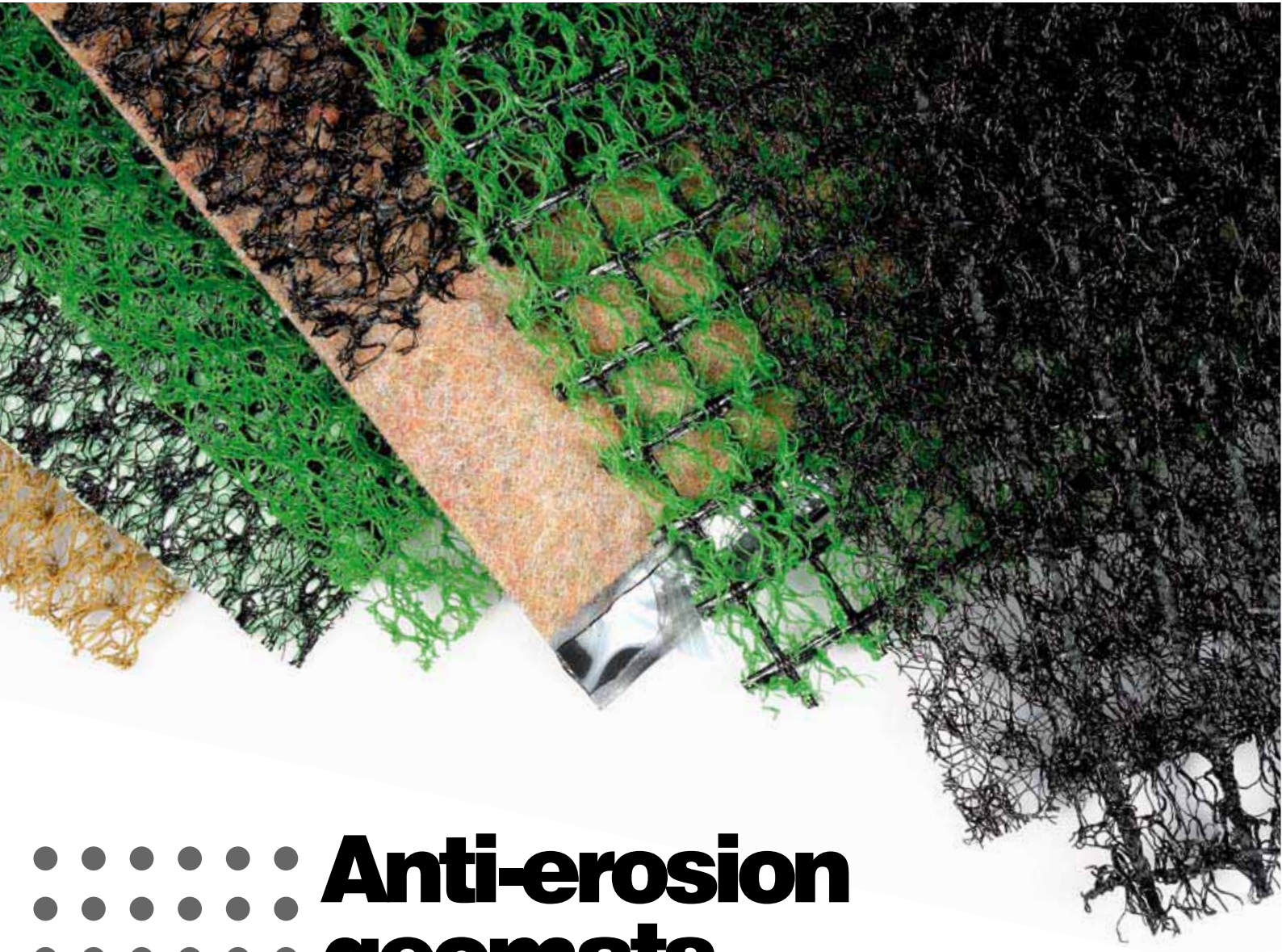
This is why **Maxistud** can be used as an effective replacement for the usual layer of lean concrete between the soil and the foundation platform or for adding loose stone foundations to basements. The **Maxistud** membrane is also an effective barrier against radon gas.

TeMa
Technologies and Materials

Maxistud is suitable wherever a cavity needs to be built. For example, in building construction it can be used as a replacement for the layer of lean concrete between the soil and the foundation platform or for adding loose stone foundations to basements.



Maxistud can also be used in tunnels as the drainage component in the foundation platform, to evacuate water seepage which could damage sub-services, apart from avoiding the risk of pressure overload.



Anti-erosion geomats

The growing use of cement in the environment and the abandonment of mountain and hill areas has increased the occurrence of mudslides, landslides and rockslides etc. At the same time growing public awareness has led to the development of more environmentally aware policies aimed not only at preventing damage caused by these events but also at managing the environment in a sustainable way. The prevention of surface erosion is a crucial part of modern environmental protection practices. Erosion control products and practices ensure that at-risk fine soils are preserved with their plant growing capacity intact, and rain damage is reduced as much as possible, protecting the subsoil from the wind, protecting seeds used to revegetate and helping seeds to germinate.
TeMa offers a variety of comprehensive solutions, including three-dimensional geomats such as **KMat**, which can adapt to a range of requirements in the area of surface erosion control and environmental renewal.

KMat

A three-dimensional anti-erosion geomat made from extruded synthetic polypropylene monofilaments, tangled together and welded where they cross. With its high void ratio three dimensional structure **KMat** is especially suited for saturating with granular material, generally plant soil.

KMat RF

A three-dimensional anti-erosion geomat made from extruded synthetic monofilaments, tangled together and welded where they cross. **KMat**'s special reinforced structure gives the product greater resistance to traction.

KMat WP

A three-dimensional anti-erosion geomat made from extruded synthetic monofilaments, tangled together and welded where they cross. **KMat WP** is heat welded to a polyolefin membrane which makes it fully impermeable.

KMat Sedum

A three-dimensional anti-erosion geomat combined with a pre-sown filter. **KMat Sedum** is particularly suited for saturation with granular material, generally plant soil, and does not need subsequent water-sowing but just suitable watering. **KMat Sedum** is well suited for the front of reinforced earthworks.

TeMa
Technologies and Materials

Product	Coupling	Section	Thickness (mm)	Resist. to traction (kN/m)	Main application	Special features
KMat Super L	-		22	2	very steep slopes	
KMat Super L Green	-		22	2	very steep slopes	Green
KMat L	-		17	1,8	Medium slopes	
KMat L Green	-		17	1,8	Medium slopes	Green
KMat L Light Brown	-		17	1,8	Medium slopes	Brown
KMat Mini L	-		10	1,3	shallow slopes	
KMat F	-		10	1,3	Reinforced earthworks	
KMat RF 10	geogrid		19	10	water courses	
KMat RF 10 Green	geogrid		19	10	water courses	Green
KMat RF 20	geogrid		19	25	water courses	
KMat RF 35	geogrid		19	35	water courses	
KMat RF 55	geogrid		19	55	water courses	
KMat C 15 WP	waterproof membrane		18	-	earthen canals	
KMat C 15 WP B	waterproof membrane		18	-	earthen canals	butyl adhesive strip
KMat Mini L Sedum	seeded felt		10	2,3	shallow slopes	green without hydro-sowing
KMat F Sedum	seeded felt		10	2,3	Reinforced earthworks	green without hydro-sowing

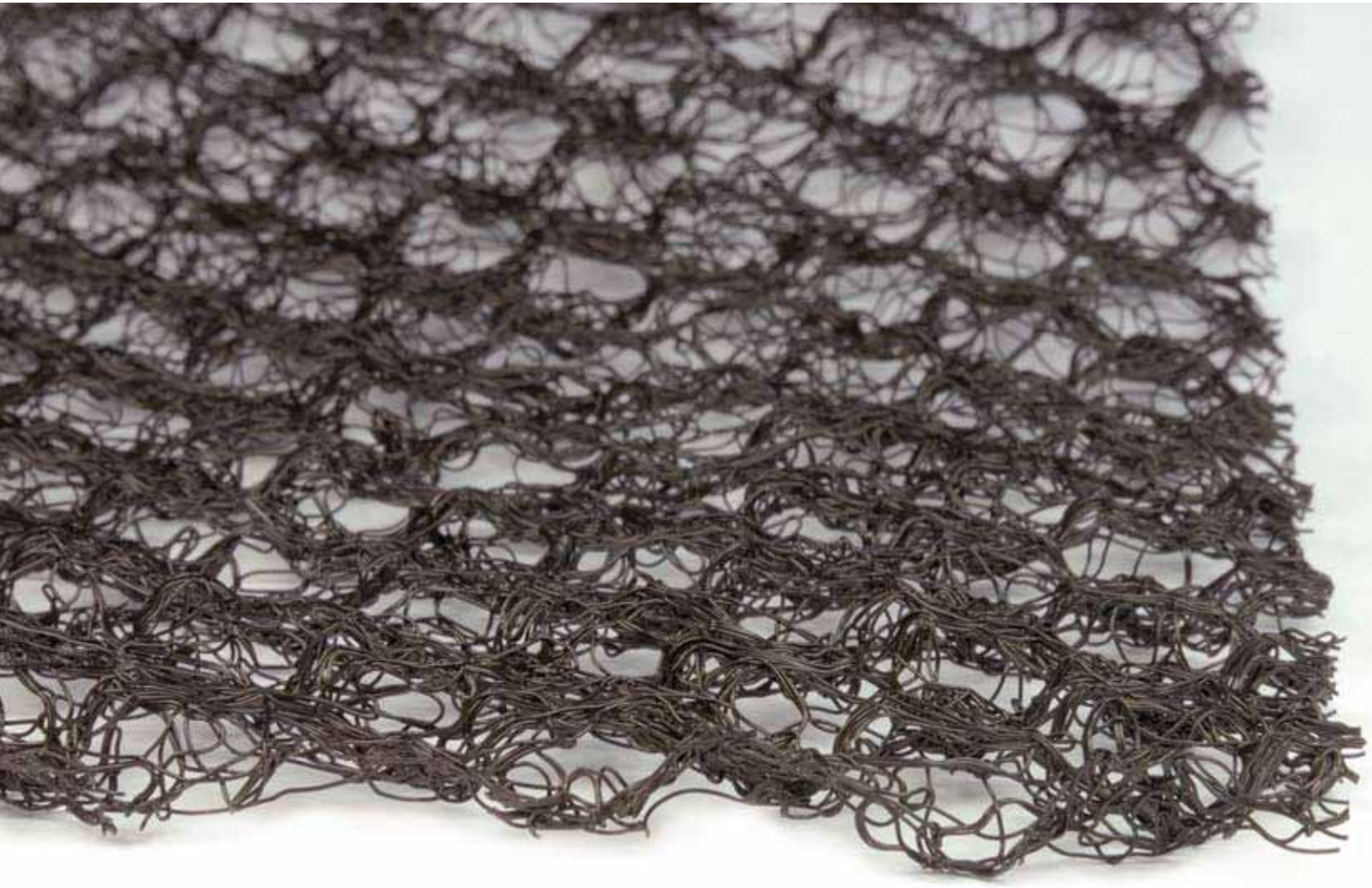
Initial stage of grass growing on a slope using KMat Mini L Sedum

Building the bank of a water canal with Reinforced earthworks. The front-line anti-erosion component is KMat F Sedum.

Lining a water course using a reinforced KMat RF 55 geomat

Anti-erosion geomats

Anti-erosion stabilisation of a slope on the bank of a water canal using KMat L



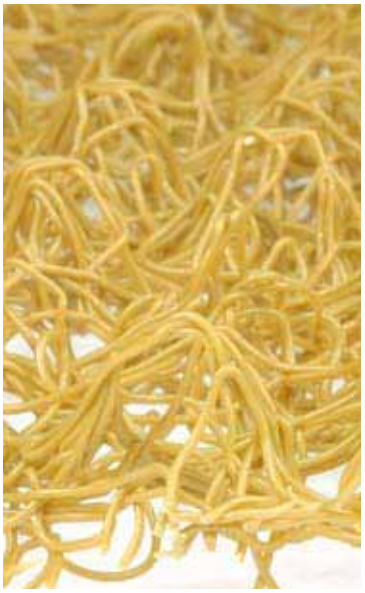
KMat

Structure

A three-dimensional anti-erosion geomat made from extruded synthetic polypropylene monofilaments, tangled together and welded where they cross. With its three-dimensional high void ratio structure **KMat** is especially suited for saturation with granular material, generally plant soil. It is available in various thicknesses and with a variety of retention capacities. **KMat F** and **KMat Mini L** are 10 mm thick ; **KMat L** and **KMat Super L** are instead respectively 17 and 22 mm thick. For situations where it is important that the environment retains its aesthetic appeal **TeMa** also provides **KMat** in green and brown.

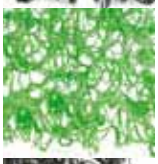
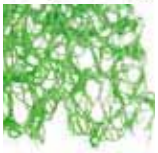
Applications

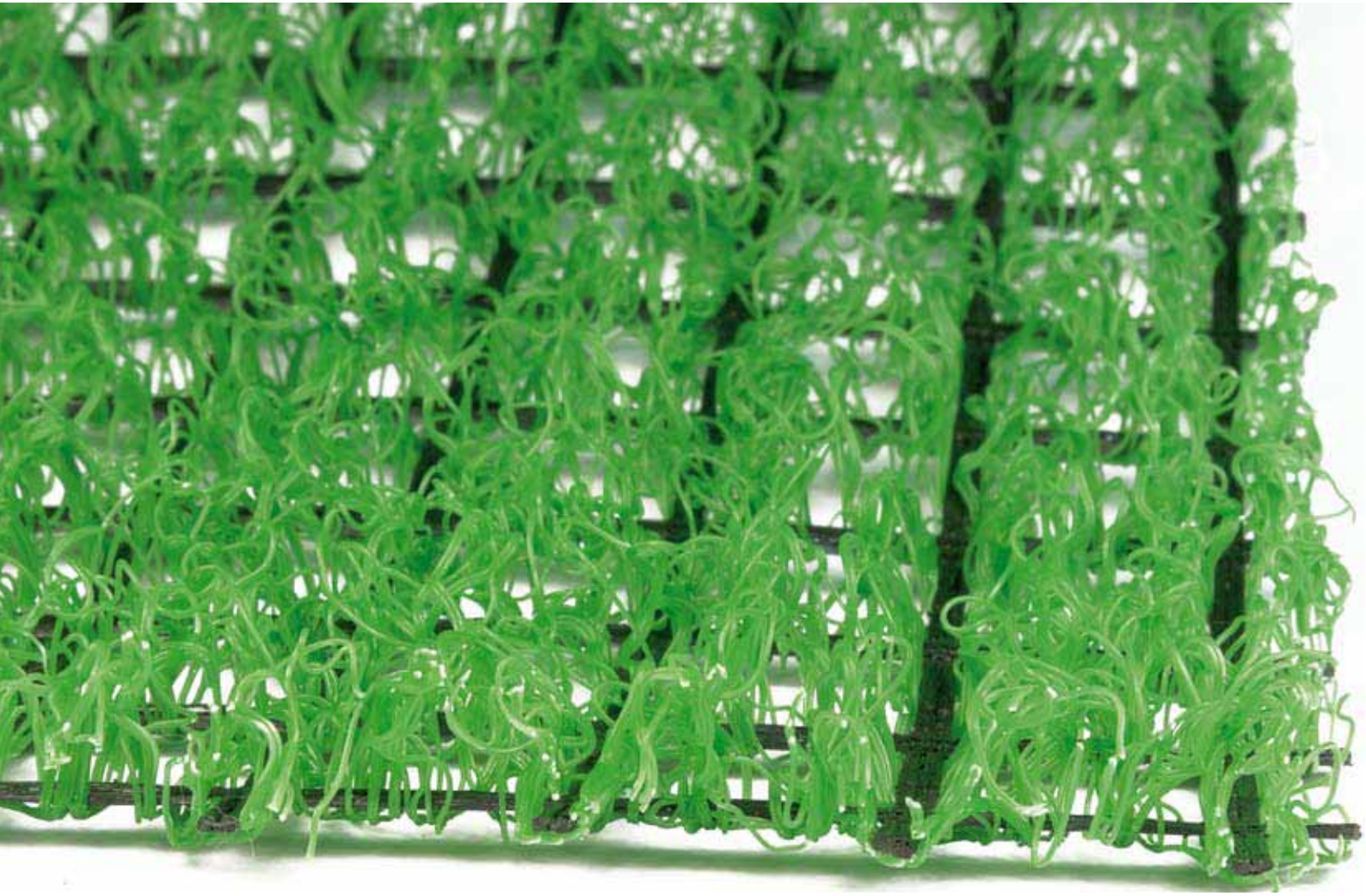
KMat's special design makes it especially suitable for environmental engineering applications to prevent slope erosion. Its three-dimensional structure retains soil particles even when subjected to the impact of rain, increasing cohesion of soil and therefore improving stability. Depending on the type of application (gentle slopes, steep slopes, reinforced earthworks) particular types may be recommended. **TeMa's** technical department is able to examine each individual case to recommend the best solution.



TeMa
Technologies and Materials

KMat used as the erosion control layer on a dry earth slope.

	Product	Thickness (mm)	Void index	Resistance to traction (kN/m)
	KMat Super L	22	>95%	2
	KMat Super L Green	22	>95%	2
	KMat L	17	>95%	1,8
	KMat L Green	17	>95%	1,8
	KMat L Light Brown	17	>95%	1,8
	KMat Mini L	10	>95%	1,3
	KMat F	10	>95%	1,3



KMat RF

Structure

A three-dimensional anti-erosion geomat made from extruded synthetic polypropylene monofilaments, tangled together and welded where they cross. With its three-dimensional high void ratio structure **KMat RF** is reinforced by adding a synthetic fibre geogrid which gives the finished product greater resistance to traction. Depending on the type of geogrid used resistance to traction varies from about 10 to about 55 kN/m. It is also available in the **KMat RF Green** version, where the geomat is green.

Applications

KMat RF is the ideal solution for all those applications where - apart from an anti-erosion capacity - high resistance to traction is needed. In particular **KMat RF** is recommended for anti-erosion applications in water courses and in consolidation work on earth slopes and, in conjunction with other products, rock walls.

TeMa
Technologies and Materials

KMat RF's special structure means it can be used as the erosion control layer in a water course. The picture shows the product before the soil layer is restored.

Anti-erosion geomats

	Product	Thickness (mm)	Void index	Resistance to traction (kN/m)
	KMat RF 10	19	>95%	10
	KMat RF 10 Green	19	>95%	10
	KMat RF 20	19	>95%	25
	KMat RF 35	19	>95%	35
	KMat RF 55	19	>95%	55

KMat WP

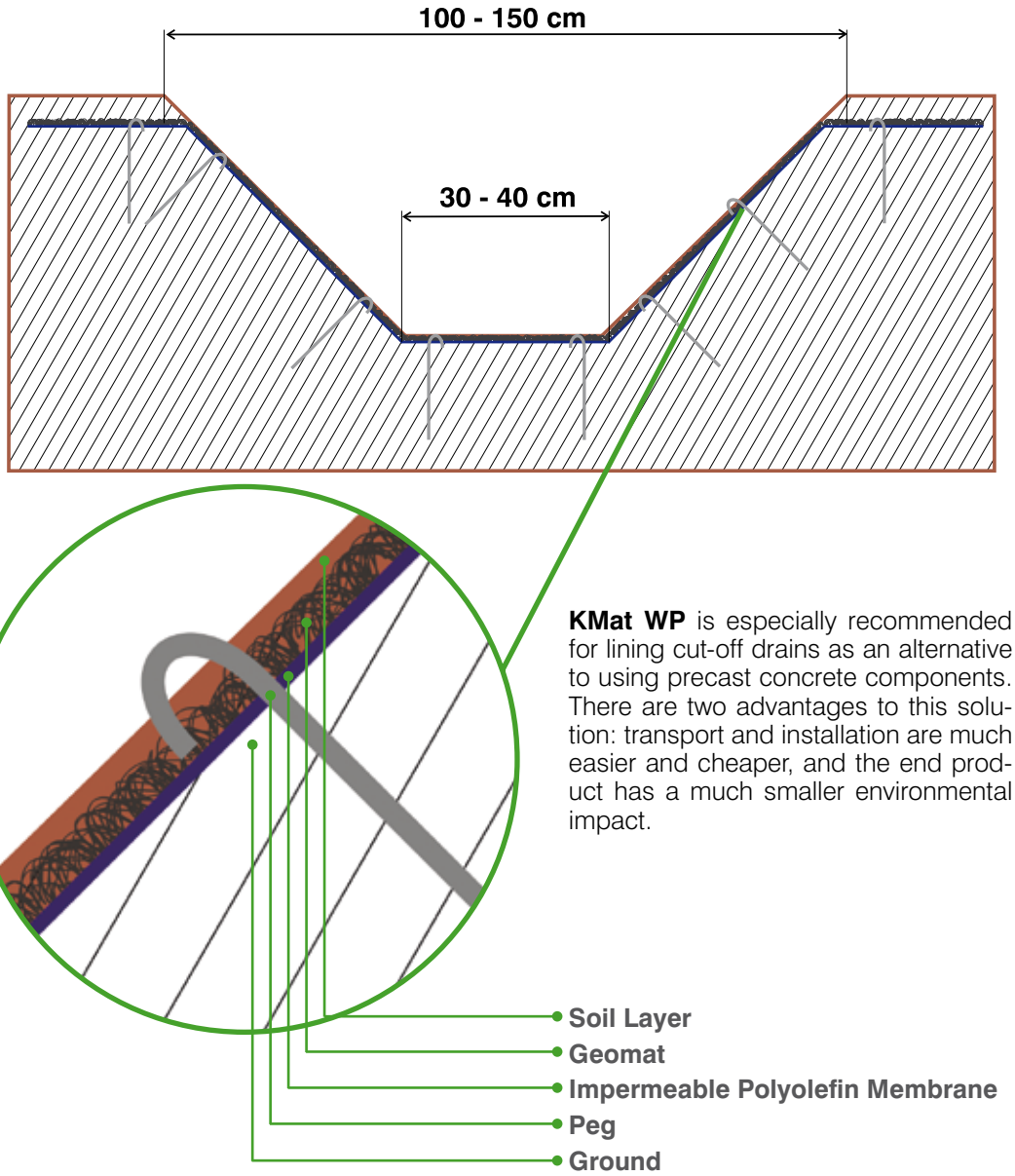
Structure

A three-dimensional anti-erosion geomat made from extruded synthetic polypropylene monofilaments, tangled together and welded where they cross. With its three-dimensional high void ratio structure **KMat C 15 WP** is combined with a waterproofing polyolefin membrane. This composite therefore has an anti-erosion geomat on one side and a waterproofing membrane fitted with a 15 cm (approx.) selvage on the other side. The **KMat C 15 WP B** version also has a butyl adhesive strip to ensure a perfect waterproof seal even when rolls are laid side by side.

Applications

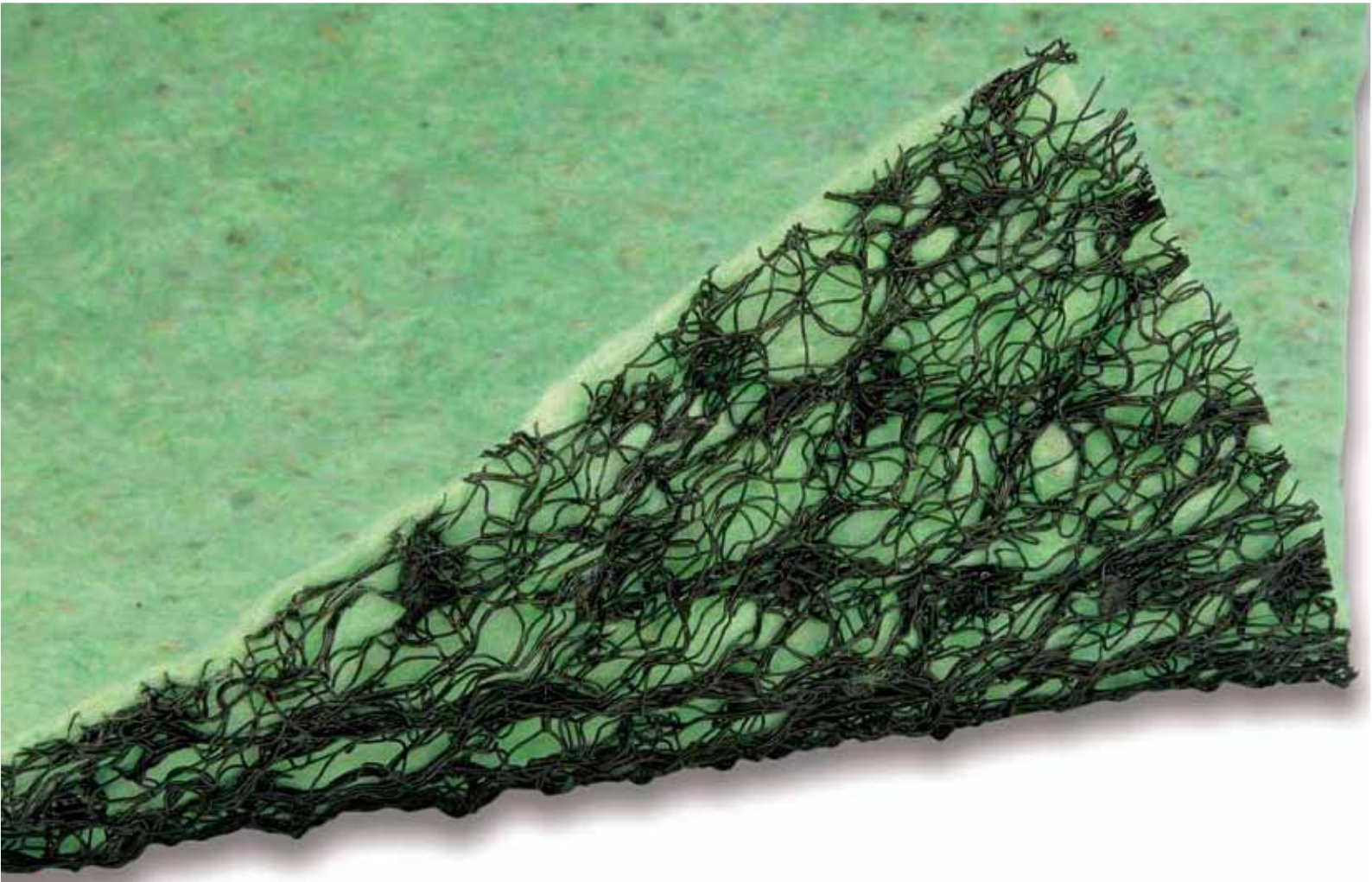
KMat WP has been designed for applications where anti-erosion features must be accompanied by a waterproofing capacity, for example when building earth drainage canals.

TeMa
Technologies and Materials



KMat WP is especially recommended for lining cut-off drains as an alternative to using precast concrete components. There are two advantages to this solution: transport and installation are much easier and cheaper, and the end product has a much smaller environmental impact.

Product	Thickness (mm)	Void inde	Weight (g/m²)
KMat C 15 WP B	18	>95%	1.200
KMat C 15 WP	18	>95%	1.200



KMat Sedum

Structure

A three-dimensional anti-erosion geomat made from extruded synthetic polypropylene monofilaments, tangled together and welded where they cross. With its three-dimensional high void ratio structure **KMat Sedum** is combined with a green biofelt which is completely biodegradable. Biofelt made from cellulose fibre incorporates high quality seeds and the right amount of fertilizer to ensure the growth of a healthy green cover of grass.

Applications

The qualities of **KMat Sedum** come to the fore on steep slopes.
This is why it has been used so successfully in environmental renewal and regreening projects requiring natural engineering solutions to achieve an effective grass cover. **TeMa** has developed **KMat F Sedum** for use as an anti-erosion product with reinforced earthworks. Apart from protecting the surface against erosion it ensures a good grass cover without the need for hydro-sowing.

TeMa
Technologies and Materials

In gardens situated on slopes or land subject to runoff the use of **KMat Sedum** has the twin benefits of consolidation and providing grass cover. With its ease of installation a perfect outcome is guaranteed in a short space of time and following a standard irrigation schedule.

	Product	Thickness (mm)	Void inde	Weight (g/m²)
	KMat Mini L Sedum	10	>95%	450
	KMat F Sedum	10	>95%	450

Anti-erosion Bionets and Biomats

Both the public and private sectors share a desire to preserve and protect the settled environment against internal and external threats to its amenity.
Soil erosion is undoubtedly an important part of this and is why natural (biodegradable) products have been added to the range of available synthetic products. In line with this trend **TeMa** produces both geosynthetic erosion control systems and completely natural products such as the **Ecovermat** and **Ecovernet** ranges.
Ecovermat is a completely biodegradable natural (straw and coconut fibre) range, available in a pre-sown option, designed to provide appropriate surface protection (closed weave). Also available is a green pre-sown biofelt, **Ecovermat Sedum**, designed to provide a comprehensive range of biodegradable erosion control solutions.
Meanwhile, **Ecovernet** is part of the bionet range, is also made from 100% open weave natural fibres and therefore biodegradable.
Both are suitable erosion control solutions for reinforced earthworks.

Ecovermat

A biodegradable natural fibre biomat with fibres enclosed in synthetic containment micronets, available in straw/coconut fibre (**Ecovermat PC 450**) and pre-sown straw/hay (**Ecovermat P Sedum**).
Where the project needs to be camouflaged **TeMa** provides a green pre-sown biofelt (**Ecovermat Sedum**) which avoids the need for hydro-sowing after installation.

Ecovernet

An open weave bionet also made entirely from natural fibres. Used mainly to line escarpments subject to erosion, **Ecovernet** differs from **Ecovermat** in that it has a large weave.
Like **Ecovermat**, **Ecovernet** is fastened to the substrate requiring protection using metal pegs.
It is available in two weight versions (100 and 500 gr/ m^2); the 500 gr/ m^2 version comes in two widths: 1.22 m and 2.42 m.

TeMa
Technologies and Materials

Instructions for use

1. Clean up the bank or escarpment by removing any root systems
2. Prepare a 20 - 30 cm trench upstream of the escarpment
3. Place the product inside the trench fastening it with metal pegs
4. Sow
5. Lay the product along the bank or escarpment and overlap adjacent sheets at least 10 cm
6. Fasten the mat with U-shaped metal pegs along overlapping sections
7. Fasten the mat at the foot of the escarpment
8. Plant seedlings as required
9. Fertilise and irrigate as required

Product	Section	Resist. to traction (kN/m)	Special features
Ecovermat PC450	closed weave	0,5	
Ecovermat P Sedum	closed weave	-	seeded
Ecovermat Sedum	bio-felt	0,98	seeded
Ecovernet J 100	open weave	-	
Ecovernet J 500	open weave	10	
Ecovernet J 500 XL	open weave	10	greater width

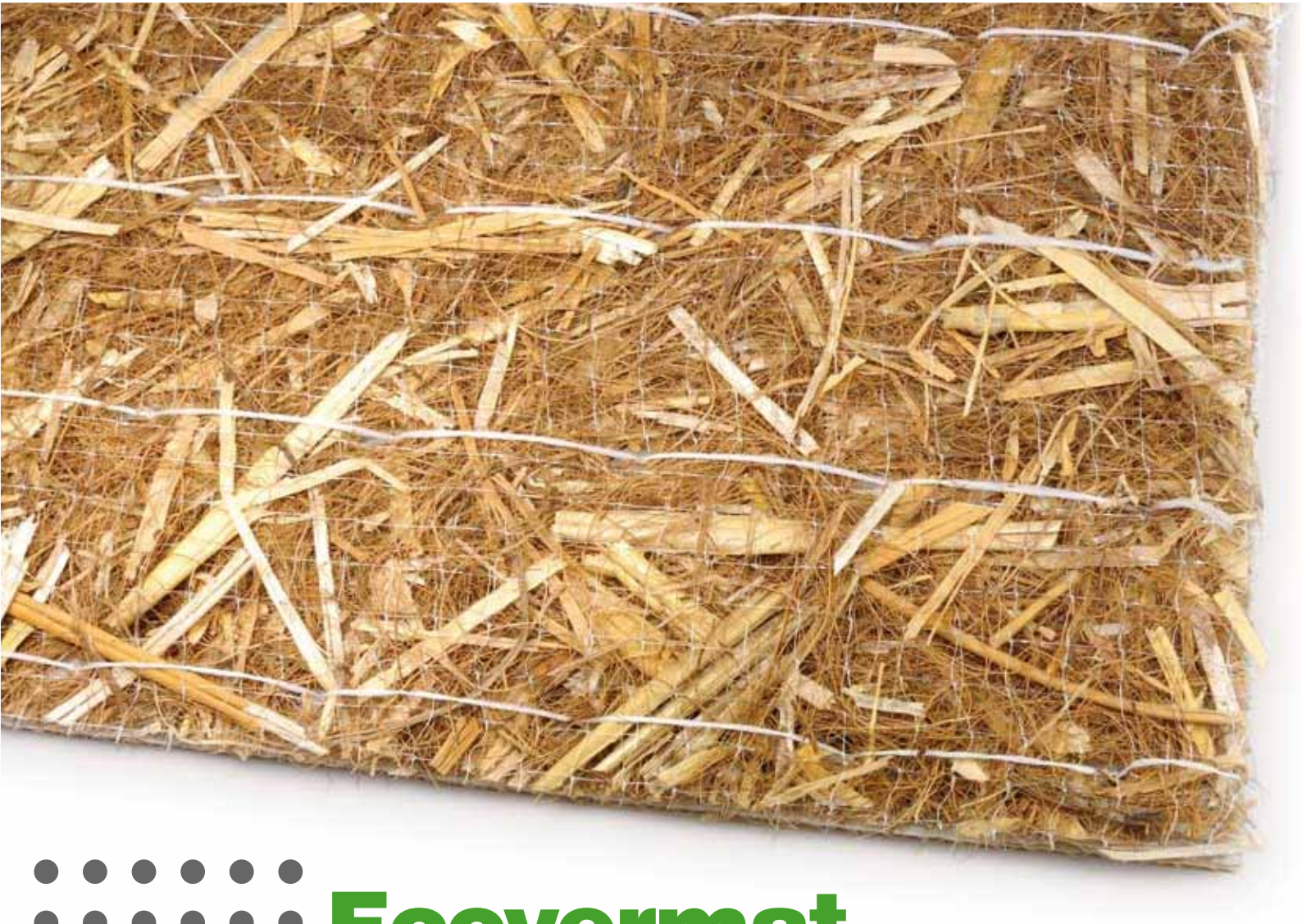
Use of Ecovernet J 500 as an erosion prevention layer on the edge of a decantation pond

Ecovernet is a more ecologically friendly alternative to synthetic geomats in Reinforced earthworksworks.

Detail of the biomat anchorage trench

Anti-erosion bionets and biomats

Ecologically sound reinforcement of the bank of a man-made canal using the Ecovermat anti-erosion mat



Ecovermat

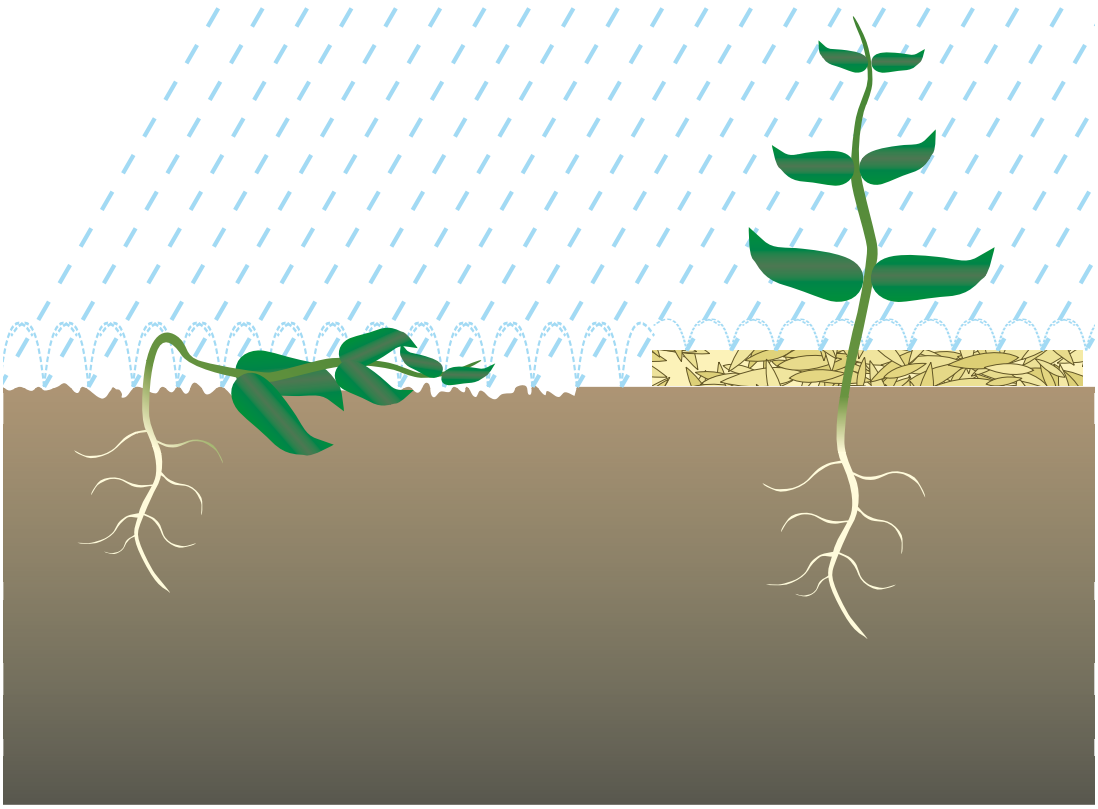
Structure

A biodegradable natural fibre biomat with fibres enclosed in synthetic containment micronets, available in straw/coconut fibre (**Ecovermat PC 450**) and pre-sown straw/hay (Ecovermat P Sedum).
The range of natural anti-erosion products includes a green pre-sown biofelt (**Ecovermat Sedum**) which has the added advantage of colour.

Applications

With their closed weave biomats reduce erosion by rainwater and provide seed protection. They have the further advantage of retaining moisture to improve germination and plant root growth. Subsequent breakdown adds fertilisers and nutrients to the substrate.

TeMa
Technologies and Materials



The **Ecovermat** geomat also protects soil (whether sloping or flat) and young plants against driving rain. The biomat prevents seeds from being displaced and - after germination - plants enjoy the benefits of flat, compact soil even with heavy rain.



Product	Ecovermat PC 450	Ecovermat P Sedum	Ecovermat Sedum
Fibre type	straw and coconut	straw and hay	cellulose
Other components	PP net	PP net	fertilizer
Seeded	no	yes	yes
Areic mass (g/m²)	450	500	110
Resistance to traction (MD)	500 N/m	500 N/m	980 N/m
Resistance to traction (CMD)	500 N/m	500 N/m	600 N/m
Stretching to breaking point (MD / CMD)	< 20%	< 20%	42% / 125%

Ecovernet

Structure

A large weave bionet made from 100% jute fibre. The product is available in two different weights: **Ecovernet J 100** at 100 g/m^2 and **Ecovernet J 500** at 500 g/ m^2.
The latter is available in two widths: 1.22 m and 2.42 m.

Applications

With a higher resistance to traction than biomats the products in the **Ecovernet** range are suited for use on steep slopes. Their in-built flexibility makes them ideal where the substrate is uneven (depressions, protrusions, holes etc.).
The open weave promotes the growth of plants with large root systems.

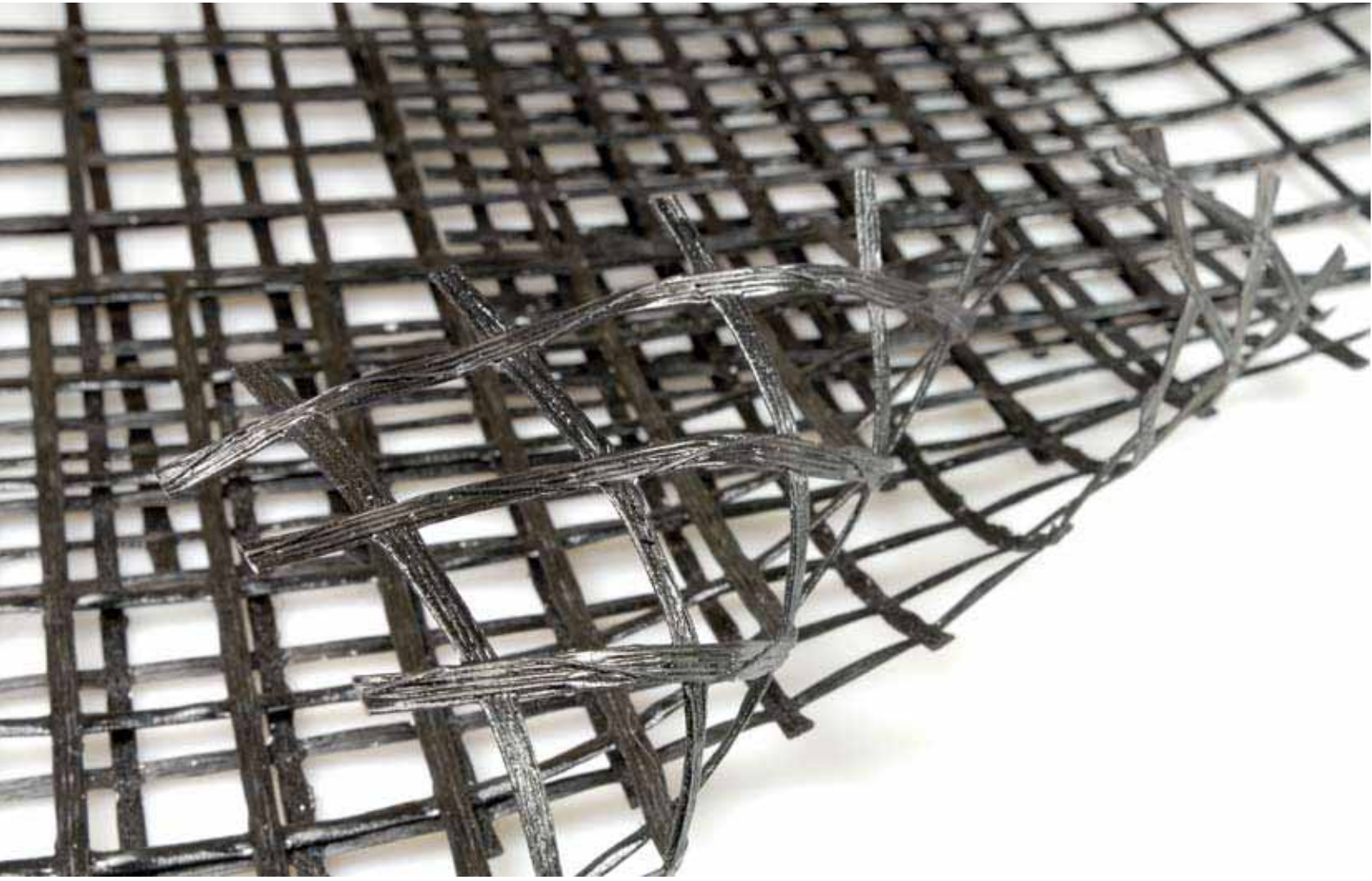
TeMa
Technologies and Materials

When working on reinforced earthworks the use of **Ecovernet J 100** combined with **XGrid** is the right choice for the environment. **Ecovernet J 100** is ideal for containment and retaining soil compactness while growing a grass cover.

Installing **Ecovernet J 500** in municipal road-works.



Product	Ecovernet J 100	Ecovernet J 500	Ecovernet J 500 XL
Fibre type	jute	jute	jute
Areic mass (g/m²)	105	500	500
No. threads per 10 cm (weft / warp)	19 / 17	6,5 / 4,5	6,5 / 4,5
Resistance to traction (MD)		10 kN/m	10 kN/m
Resistance to traction (CMD)		8 kN/m	8 kN/m
Stretching to breaking point		4,5%	4,5%



Reinforcement geogrids

CE

Now more than ever there is a need for solutions that minimize the impact on the environment.
With regard to support work there is definitely a solution: the use of geogrids on appropriate soils has led to low environmental impact support projects. When geogrids are laid in layers of up to 60 cm reinforced earthworks camouflage their presence in the environment thanks to their in-built revegetation ability.
Apart from their success from the environmental point of view, which is typical of regreening reinforced earthworks products, **XGrid** geogrids are also suited to any situation requiring an improvement in the geotechnical characteristics of earthworks that have a tendency to subside. Typical uses therefore are the reinforcement of road or railroad sub-foundations, and the stabilisation of slopes below 45°.

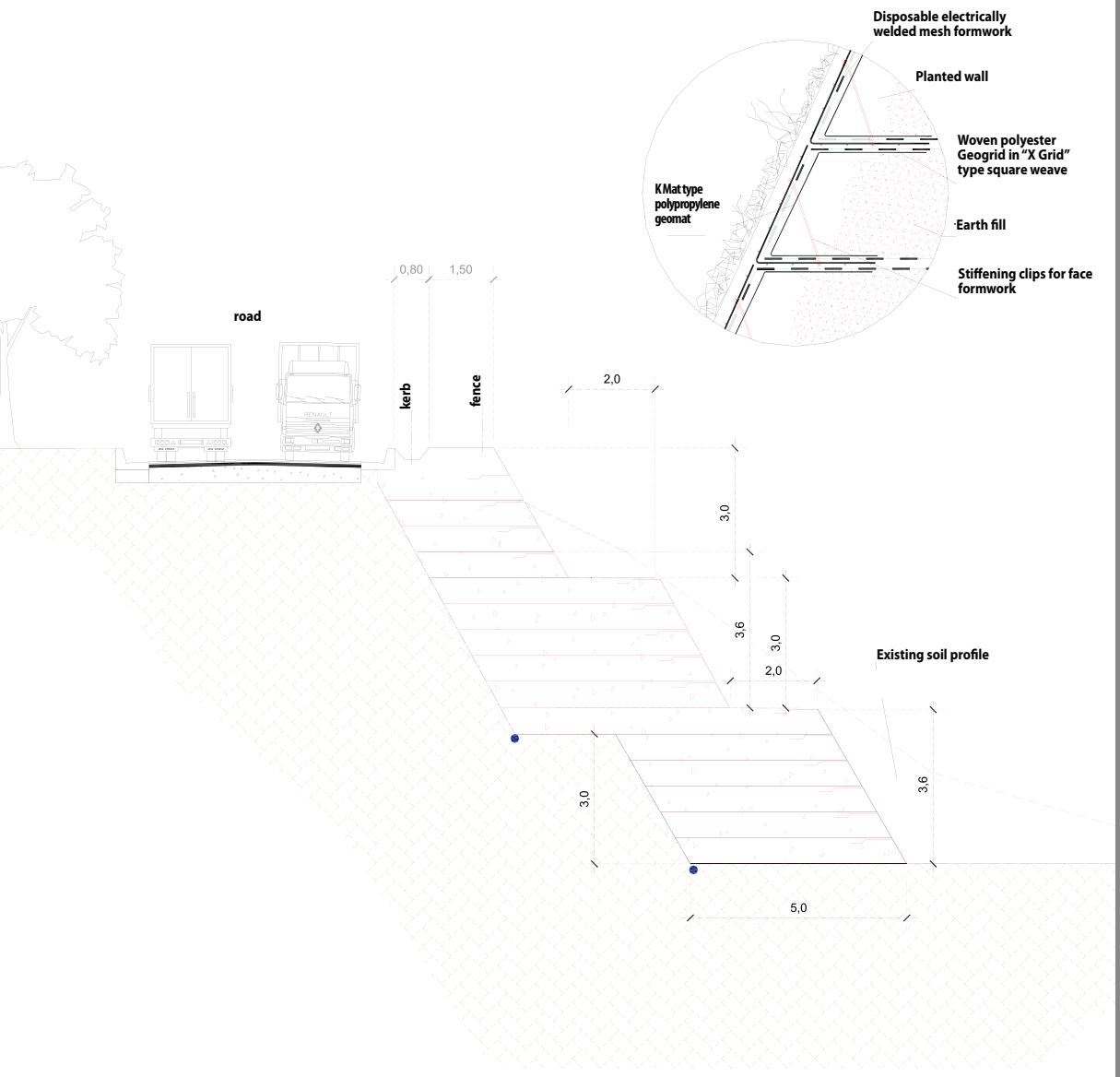
XGrid PET

Reinforcement geogrids made from extruded synthetic polyester filaments with a protective covering (PVC, EVA etc.).
The range varies according to different resistances to traction. Apart from the different resistances shown in the table on the next page **TeMa** also supplies products with higher resistance to traction (up to 600 kN/m) and that are characterised by isotropic resistance.

XGrid FG

A reinforcement geogrid for asphalt made from woven synthetic fibreglass fibre (FG) with an appropriate protective covering (EVA, SBR, etc.).
The range includes two isotropic resistance classes (50 and 100 kN/m).
For special purposes **TeMa** also provides geogrids combined with non-woven geotextiles.

TeMa
Technologies and Materials



Product	Raw material	Lining	Weave dimensions. MD x CMD (mm)	Max. resist. to traction (kN/m) (*)	Isotrope
XGrid PET PVC 40/30 AX	PET	PVC	25 x 28	40	no
XGrid PET PVC 60/30 AX	PET	PVC	24 x 28	60	no
XGrid PET PVC 80/30 AX	PET	PVC	23 x 28	80	no
XGrid PET PVC 110/30 AX	PET	PVC	21 x 28	110	no
XGrid PET PVC 150/30 AX	PET	PVC	20 x 28	150	no
XGrid PET PVC 200/30 AX	PET	PVC	19 x 28	200	no
XGrid FG EVA 50/50 A	FG	EVA	25 x 25	55	sì
XGrid FG EVA 100/100 A	FG	EVA	12,5 x 12,5	110	sì
XGrid FG SBR 50/50 I	FG	SBR	25,4 x 25,4	50	sì
XGrid FG SBR100/100 I	FG	SBR	25,4 x 25,4	110	sì

(*) MD: Machine Direction (lengthwise)
CMD: Counter Machine Direction (across)

Use of XGrid to build a terraced vineyard

This photo montage shows the final stages of a Reinforced earthworks project: grass grown through hydroseeding and the result.

Building a rockfall protection embankment. The use of XGrid ensures environmental and aesthetic criteria are met.

Reinforcement geogrids

In residential construction designers can use XGRid features creatively.

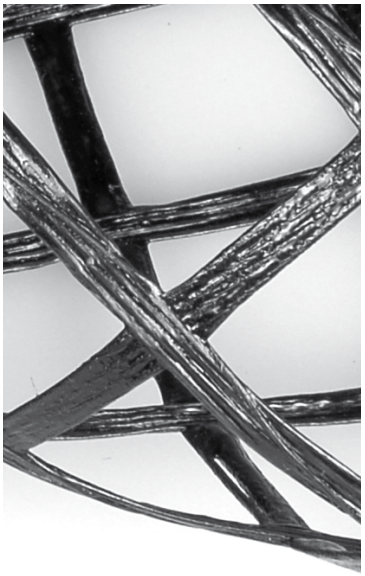
XGrid PET

Structure

A reinforcement geogrid, made from woven high-resistance synthetic polyester filaments with a protective layer (PVC, EVA, etc.). The size of the **XGrid PET** weave depends on the resistance to traction and ranges from a minimum of 25 mm to 30 mm. Resistance to traction ranges from 20 kN/m to 600 kN/m while deformation at breaking is between 10% and 12%.

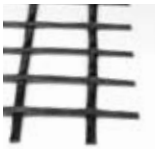
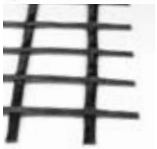
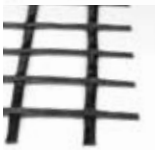
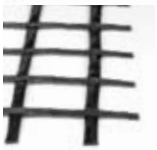
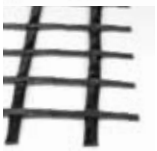
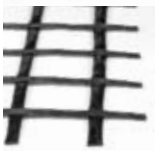
Applications

The **XGrid PET** reinforcement geogrid is especially recommended for improving soil geotechnics, especially when building road or railway embankments in reinforced earth and stabilising road foundations. In general **XGrid PET** is suited for supporting reinforced earthworks in any civil engineering situation - canal or watercourse banks, renewal of areas subject to landslides, rockfall protection embankments, rubbish tip containment embankments. Obviously **XGrid PET** is also quite suited for all building industry earth reinforcements.



TeMa
Technologies and Materials

XGrid PET can be used for projects in the housing, general building and environmental engineering sectors. In all cases the final outcome is a structure easily able to bear the loads and stresses of the project that is perfectly integrated with the environment. **XGrid PET** fulfils its function without being noticeable and therefore with minimal environmental impact.

	Product	Raw material / lining	Weave size MD x CMD (*) (mm)	Resistance to traction (kN/m) MD/CMD (*)	Maximum stretch under load
	**XGrid PET PVC 40/30 AX**	PET / PVC	25 x 28	40 / 30	< 10%
	**XGrid PET PVC 60/30 AX**	PET / PVC	24 x 28	60 / 30	< 10%
	**XGrid PET PVC 80/30 AX**	PET / PVC	23 x 28	80 / 30	< 10%
	**XGrid PET PVC 110/30 AX**	PET / PVC	21 x 28	110 / 30	< 10%
	**XGrid PET PVC 150/30 AX**	PET / PVC	20 x 28	150 / 30	< 10%
	**XGrid PET PVC 200/30 AX**	PET / PVC	19 x 28	200 / 30	< 12%

(*) MD: Machine Direction (lengthwise)
CMD: Counter Machine Direction (across)

XGrid FG

Structure

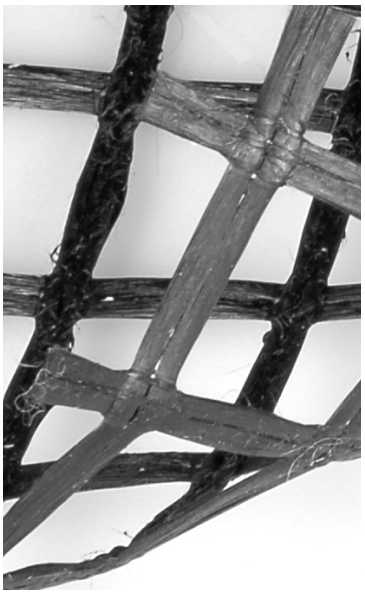
A reinforcement grid for bituminous conglomerates made by weaving fibreglass fibres impregnated with a protective layer (SBR, EVA).

XGrid FG is available in two isotropic (i.e. both directions) traction resistance classes, 50 kN/m and 100 kN/m.

The maximum deformation value of each geogrid (3 - 4% at maximum load) enables the product to shift a part of the load produced by heavy trucks directly to the synthetic layer, thereby reducing the load transmitted to the underlying layers.

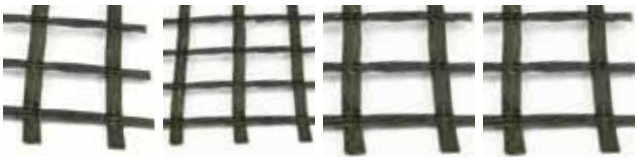
Applications

The **XGrid FG** reinforcement geogrid is designed exclusively for surface reinforcement of bituminous conglomerate roads and traffic areas (ports, airports, freight villages).



TeMa
Technologies and Materials

The use of a fibreglass geogrid, with its high elasticity, improves bituminous pavement performance. Unlike other surface reinforcement solutions **XGrid FG** fibreglass grids do not lead to any problems in the event of subsequent milling. For improved laying we recommend that a bituminous emulsion be spread over the surface to be treated and possibly plastic fasteners be inserted to prevent movement of the roll when the bitumen is spread.



Product	XGrid FG 50/50 A	XGrid FG 100/100 A	XGrid FG 50/50 I	XGrid FG 100/100 I
Raw material	Fibreglass	Fibreglass	Fibreglass	Fibreglass
Lining	EVA	EVA	SBR	SBR
Weave size (mm)	25 x 25	12,5 x 12,5	25,4 x 25,4	25,4 x 25,4
Resistance to traction MD (*) (kN/m)	55	110	> 50	> 100
Resistance to traction CMD (*) (kN/m)	55	110	> 50	> 100
Maximum stretch under load MD (*) (kN/m)	2,5%	2,5%	< 4%	< 4%
Maximum stretch under load (*) (kN/m)	2,5%	2,5%	< 4%	< 4%

(*) MD: Machine Direction (lengthwise)
CMD: Counter Machine Direction (across)

TeMa
Technologies
and Materials
www.temacorporation.com

Rev.01-09.08