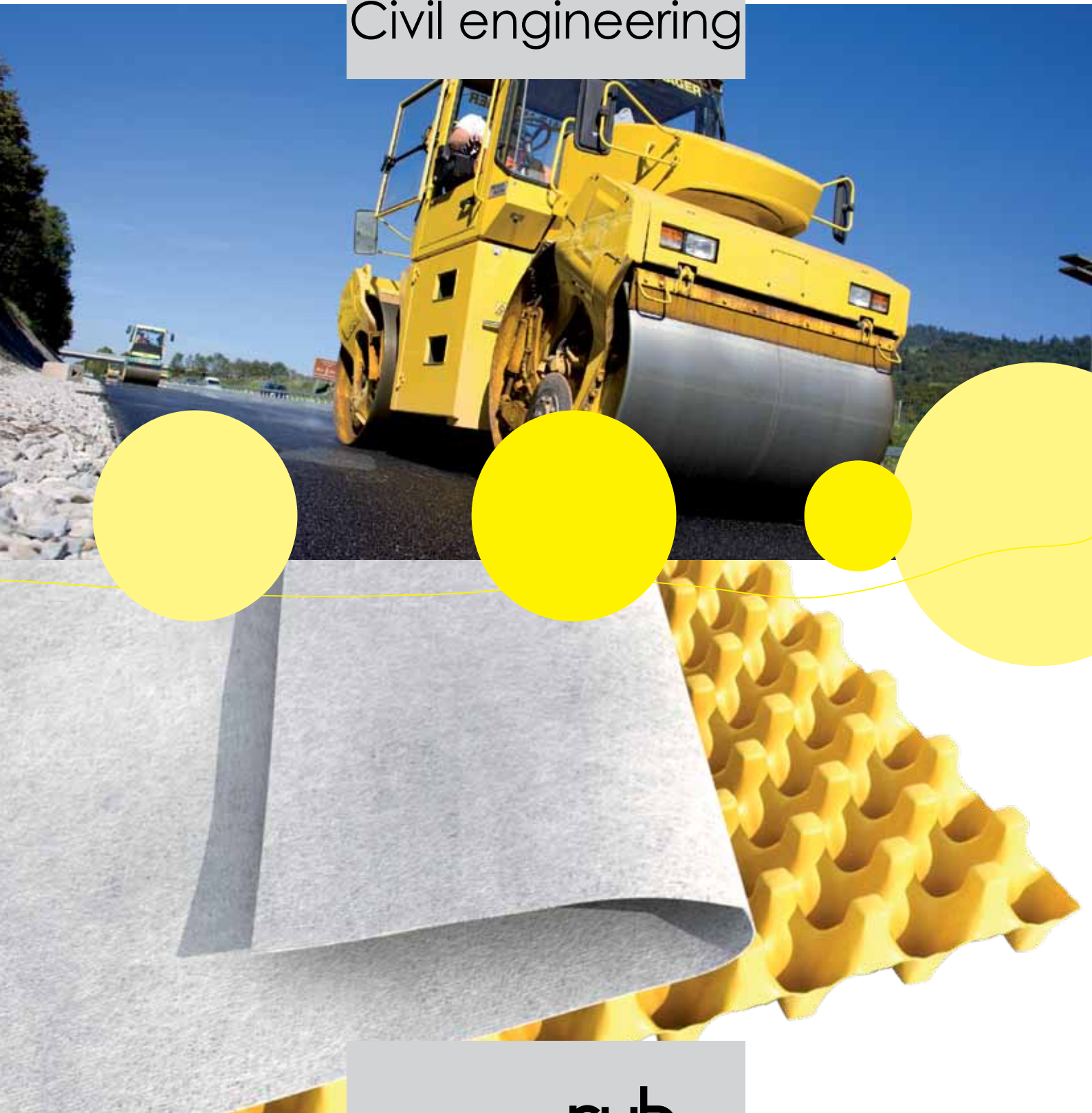


SELECTION GUIDE

Drainage geocomposites
Civil engineering

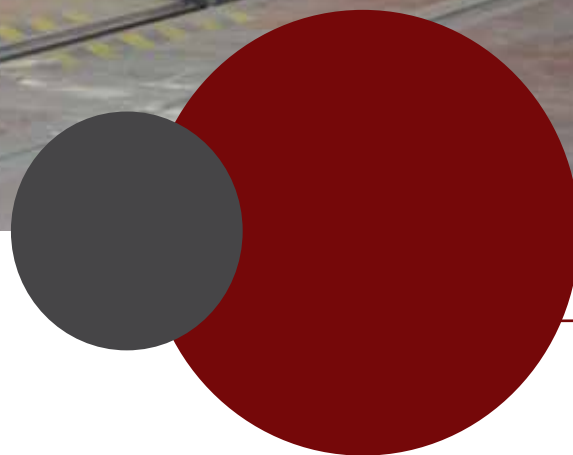
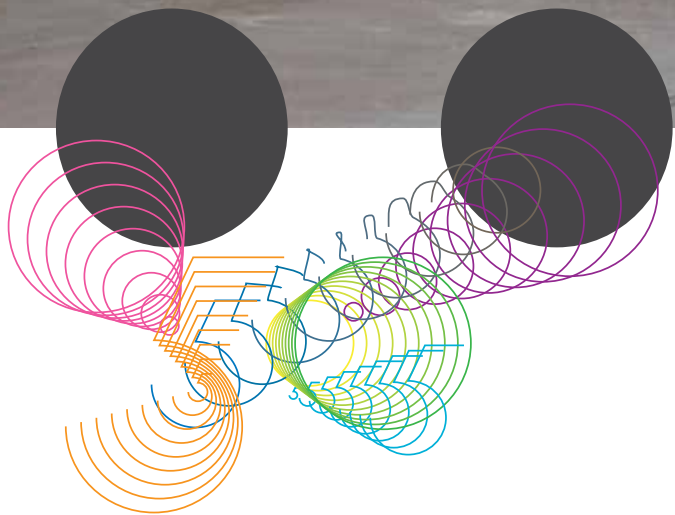


ryb
COMPOSITES 

FABRIQUE EN
FRANCE



Coating equipment
Sully sur Loire facility - France



50 years at your side

RYB has 50 years of expertise, working with professionals in the field of polymer processing.

We are a French industrial company, competitive in designing, developing and supplying global solutions around energy and the environment, in five fields of application:

- Civil engineering and networks
- Building and renewable energies
- Irrigation
- Drainage
- Industry

Modern and efficient industry



Innovative European sector

Major European company



Specialists in geocomposite drainage systems

National and international projects



Innovation – the driving force behind our growth

Backed up by our design department and the R&D division, the strength of our teams rests in their willing to promote innovation and turn it into professional solutions.

We work closely to the major research labs in France and abroad, designing and developing forward-looking systems with high added value.

Quality, innovation, environment

INNOVATION

Made in France

SUSTAINABLE & RESPONSIBLE

Made in France

High quality standards

The company has ISO 9001 certification and a strong quality, safety and environmental policy.
Our products meet the highest standards.



Drainage geocomposites

Standards and certifications

Geotextiles and related products can only be sold in Europe if they are CE marked (European Directive 89/106/EEC of 21 December 1989, amended by 93/68/EEC of 22 July 1993). This requirement means that drainage geocomposites must be compliant with the NF EN 13252 standard.

Drainage composites must undergo the following harmonised tests:

| | |
|-------------------------|------------------------|
| Tensile strength: | NF EN ISO 10319 |
| Dynamic punching | NF EN ISO 13433 |
| Filtration opening size | NF EN ISO 12956 |
| Water permeability | NF EN ISO 11058 |
| Water flow capacity | NF EN ISO 12958 |
| Durability | Annex B to NF EN 13252 |

Consequently, each roll is marked as follows :

- Brand name marked at least every 5 m (NF EN ISO 10320)
- A label fixed to each roll with the CE logo issued by a certified body and showing the ID number of the certified body, the product name and the product type.
- Supporting document for the CE marking, provided by the manufacturer on request and setting out all the information required by the NF EN 13252 standard.

Flow capacity within the plane

● Flow measurement

The hydraulic performance of a drainage geocomposite is directly linked to Q – its flow capacity within the plane measured as described in the NF EN ISO 12958 standard.

● Representative flow

The flow measured as described in the NF EN ISO 12958 standard quantifies the hydraulic performance.

● Flow over time

All geocomposites will lose thickness as a result of creep, even under light loads. The NF EN 1897 standard (compression + shear) can be used to simulate the residual thickness in a 42-day test.

All our products are extensively studied with regards to creep: RYB Composites manages creep characteristics over the long term.

● Water flow over joints

Interlocking geospacers at the joints maintain the water flow.

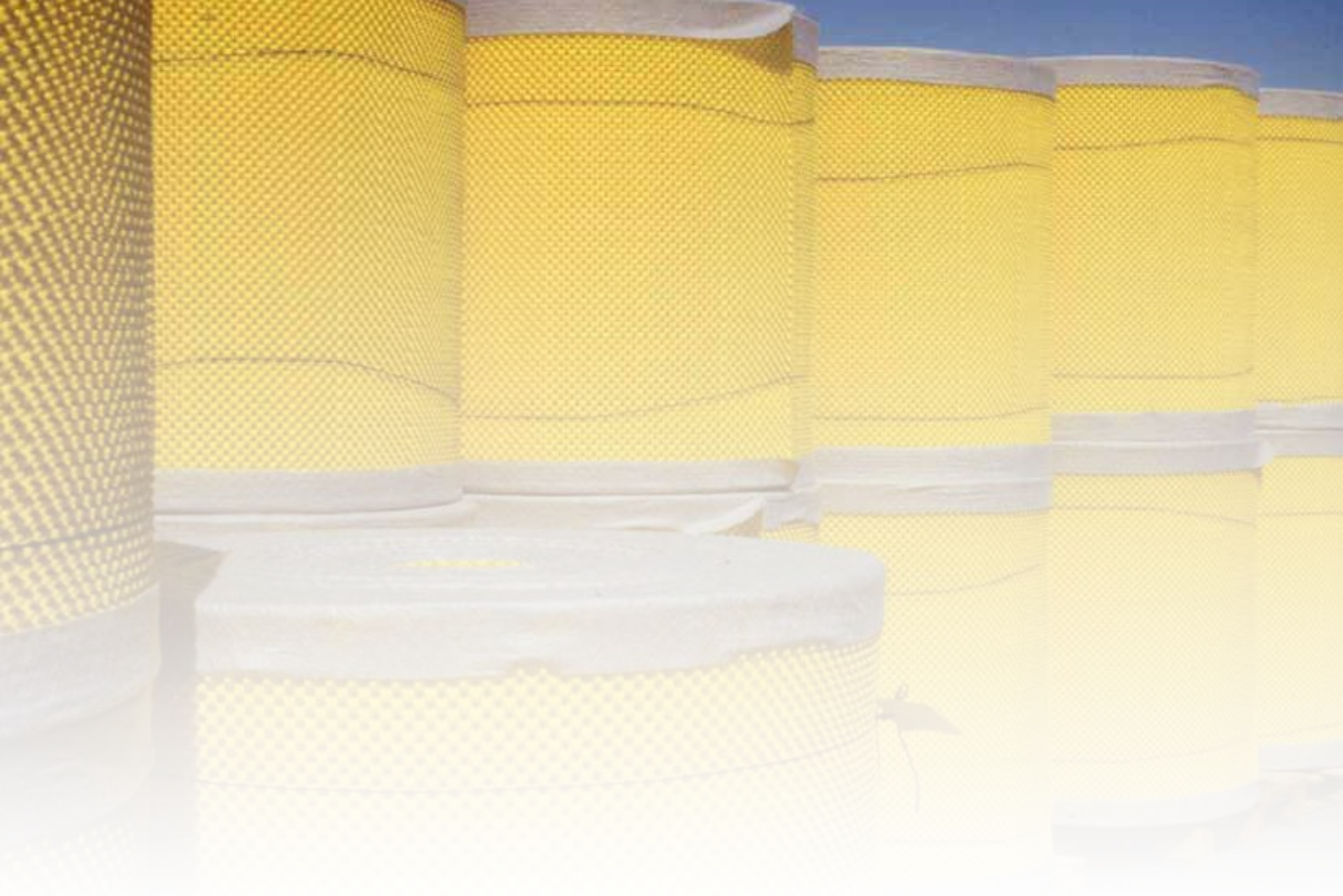
The **+** of systems
from RYB COMPOSITES


**Flow capacity
maintained under
load**

**Uniform water
circulation in all
places and in all
directions**

**Creep is managed
over the long term**

**Water flow is
maintained over the
joints**



| | |
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Vertical drainage

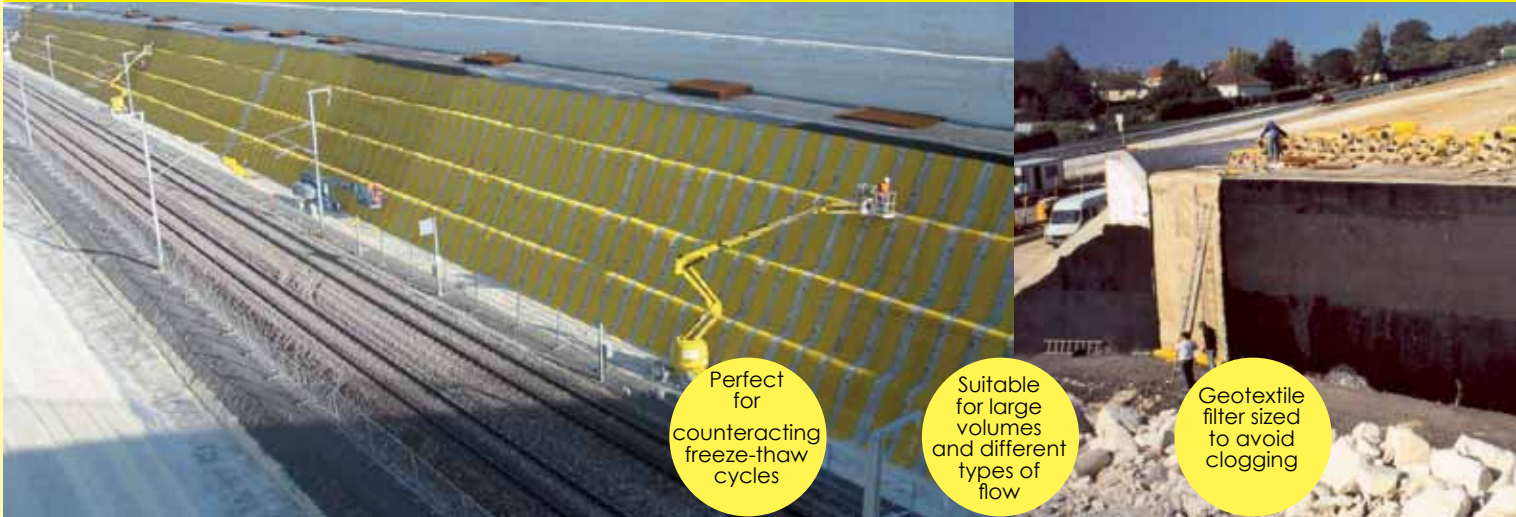
Vertical drainage – a major sizing consideration for structures

A drainage system that remains functional in the long term is essential in order to limit the hydrostatic pressure acting on the underground walls of a structure. Pressure variations are not taken into account when determining the stability of the structure.

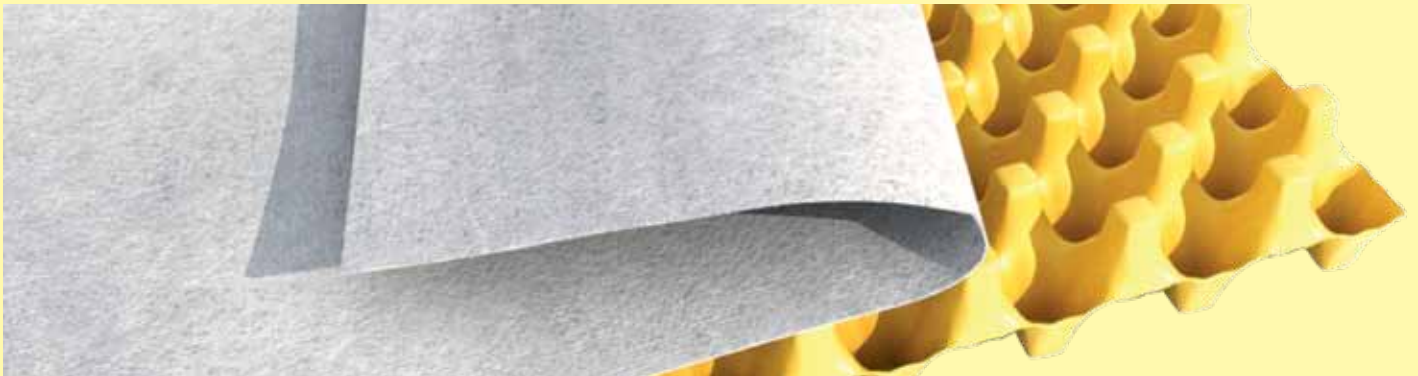
If the impermeable layer is damaged accidentally, the drainage geocomposite must limit the water that is in contact with the concrete in order to consolidate the wall.

The drainage geocomposite is installed next to the impermeable layer, which it must also protect, especially during backfilling.

Walls drainage - Embankment



Isocor (formerly Cordrain)



ISOCOR is a drainage geocomposite consisting of a thermoformed, symmetrical, waterproofed, non-compressible HDPE geospacer, thickness 8, 10 16, 20 or 40 mm, stuck to an ASQUAL certified geotextile on one side.

ISOCOR performs four main functions: Filtration / Drainage on one side / Air gap along the wall / waterproofed structure allowing the concrete to be sprayed or poured directly (formwork).

| | | | | | | |
|--|--|--|--|---|--|---|
| Thickness (NF EN ISO 9863-1) / | 8 mm | 10 mm | 16 mm | 16 mm | 20 mm | 40 mm |
| Compressive strength (NF EN ISO 25619-2) / | 150 kPa | 250 kPa | 450 kPa | 750 kPa | 250 kPa | 200 kPa |
| Flow capacity within the plane (NF EN ISO 12958) / | $2.4 \times 10^{-3} \text{ m}^2/\text{s}$ ($i=1$; 50 kPa) | $3.1 \times 10^{-3} \text{ m}^2/\text{s}$ ($i=1$; 50 kPa) | $5.0 \times 10^{-3} \text{ m}^2/\text{s}$ ($i=1$; 50 kPa) | $4.72 \times 10^{-3} \text{ m}^2/\text{s}$ ($i=1$; 50 kPa) | $5.6 \times 10^{-3} \text{ m}^2/\text{s}$ ($i=1$; 50 kPa) | $16.1 \times 10^{-3} \text{ m}^2/\text{s}$ ($i=1$; 50 kPa) |
| Installation depth / | 6 to 10 m | 10 to 16 m | 20 to 33 m | 20 to 33 m | 10 to 16 m | 10 to 16 m |
| Packaging / | Width 1,100 or 2,200 mm, 25 m roll | Width 1,100 or 2,200 mm, 25 m roll | Width 1,100 or 2,200 mm, 25 m roll | Width 1,100 mm, 25 m roll | Width 1,100 or 2,200 mm, 25 m roll | Width 1,000 mm, 25 m roll |

Vertical drainage

Soil stabilisation - Nailed walls



Technical support

RYB COMPOSITES provides technical support from product specification to installation, including validation with design calculations (equivalents for granular materials and slope stability) and guarantees related to the claimed flow capacities.



Performance

- Uniform flow surface
- The drainage crosswise is the same as the drainage lengthwise
- Long term creep resistance
- Continuous flow over joints



REFERENCE PROJECTS

Canals:

- Flood wall at Malmedy (Belgium)

Roads:

- Cut-and-cover at Porte d'Italie
- Autoroute A86 concrete spraying
- RD16 Conseil Général de Savoie Nailed wall



Railways:

- LGV lines
- Renovation of SNCF lines



Horizontal drainage

Drainage barrier

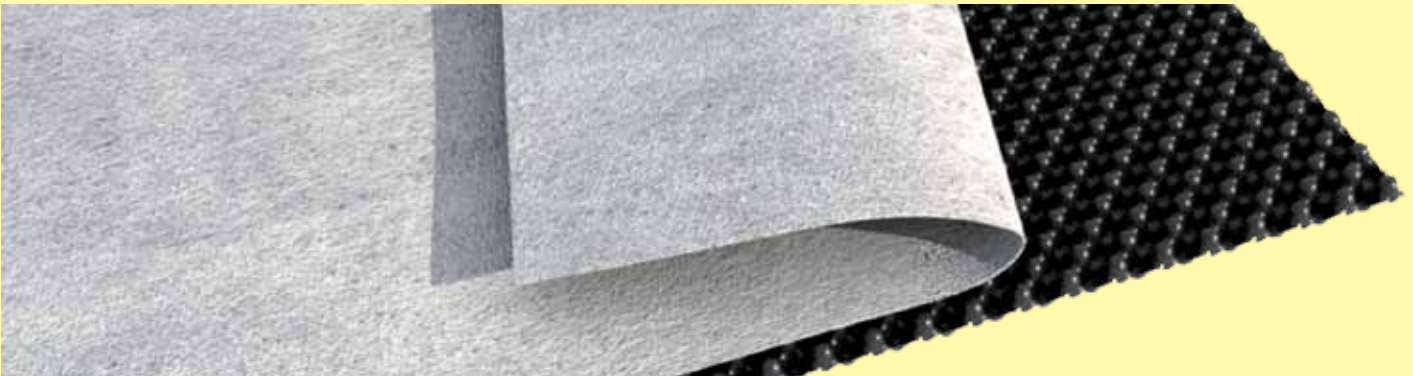
The main function of a drainage barrier is to guarantee the durability of a structure, a road, a track or an embankment:

- By draining seepage water
- By draining water rising from the subgrade by capillary action
- By preventing any movement of water between the road structure and the subgrade

Drainage barrier



Solpac Layer



Solpac Layer is a drainage geocomposite consisting of a thermoformed, symmetrical, water proofed, HDPE geospacer stuck to a geotextile on one or both sides.

| Certification / | | | | ASQUAL |
|--|--|--|--|--|
| Thickness (NF EN ISO 9863-1) / | 5 mm | 6 mm | 6 mm | 8mm |
| Compressive strength (NF EN ISO 25619-2) / | 450 kPa | 450 kPa | 900 kPa | 150 kPa |
| Flow capacity within the plane (NF EN ISO 12958) / | $6.5 \times 10^{-5} \text{ m}^2/\text{s}$ ($i=0.1$; 50 kPa) | $3.1 \times 10^{-4} \text{ m}^2/\text{s}$ ($i=1$; 20 kPa) | $7.83 \times 10^{-5} \text{ m}^2/\text{s}$ ($i=0.1$; 100 kPa) | $1.4 \times 10^{-3} \text{ m}^2/\text{s}$ ($i=1$; 20 kPa) |
| Packaging / | Width 4,300 mm - 200 m roll Width 2,200 mm - 50 m roll | Width 4,300 mm - 200 m roll Width 2,200 mm - 50 m roll | Width 4,300 mm - 200 m roll Width 2,200 mm - 50 m roll | Width 4,300 mm - 200 m roll Width 2,200 mm - 50 m roll |

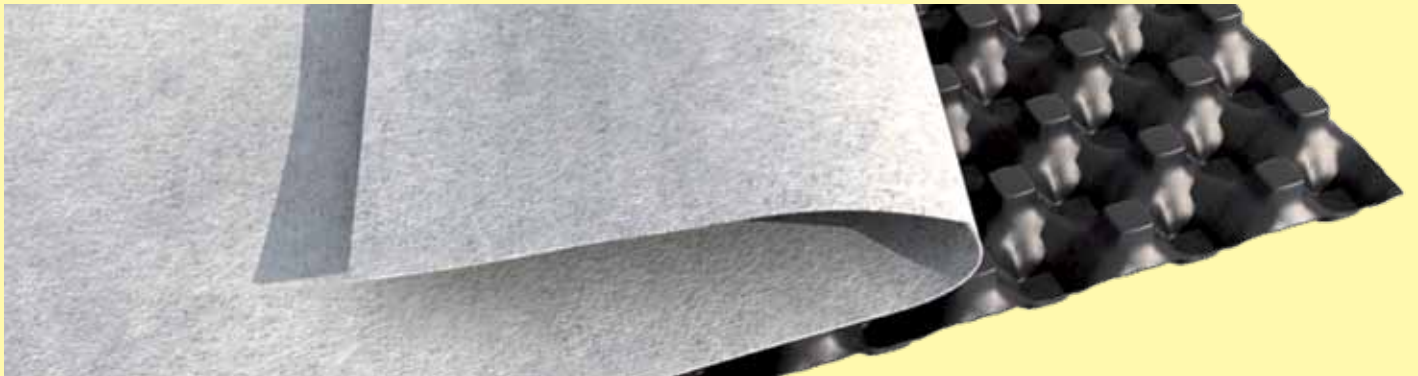


Horizontal drainage

Ditch drainage



Solpac Layer for ditches



Solpac Sheet is a drainage geocomposite with a HDPE drainage core for water seepage. This feature means it can be used to make a ditch impermeable.

The geotextile on the upper surface helps to stabilise the topsoil layer by encouraging water to circulate at the interface. The sheet is covered with a topsoil layer that is thick enough for vegetation.

Certification / ASQUAL

Thickness (NF EN ISO 9863-1) / 8 mm

Compressive strength (NF EN ISO 25619-2) / 150 kPa

Flow capacity within the plane (NF EN ISO 12958) / $3.99 \times 10^{-5} \text{ m}^2/\text{s}$ ($i=0.03$; 20 kPa)

Packaging / Width 2,200 - 3,200 or 4,300 mm (100 m rolls)

FOCUS

A concrete ditch, when there is water movement across the subgrade, is a special case, and it is sometimes necessary to install a drainage system to prevent additional load on the concrete ditch lining.

Solpac Sheet, laid with the geotextile facing the ground, is an effective solution delivering the required functions in this special case – drainage of the concrete lining (on the underside) and impermeability.





Roadside barrier

Roadside drainage

Improvement of the load carrying capacity of a road is linked to the moisture management all along the year.

Drainage has therefore a direct effect on cycle of the road.

Roadside barriers



New projects
Large volumes of water



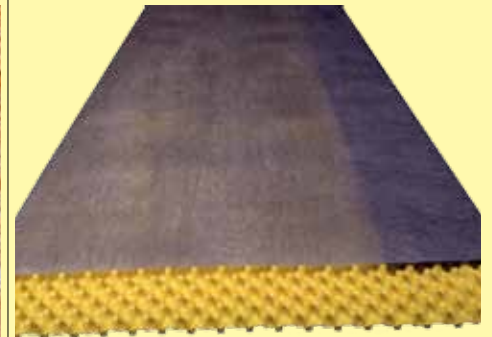
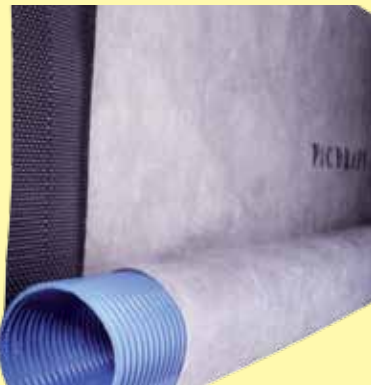
Reinforcement
Box girder roadways

Pacdrain

Roadrain

New

Stabidrain



PACDRAIN and ROADRAIN water drainage and collection solutions. They have an waterproofed core, blocking any sideways water movement. Their void ratio is higher than drainage ditches (French Trench): 0.9 compared to 0.2.

Thickness (NF EN ISO 9863-1) / 6 mm

Compressive strength (NF EN ISO 25619-2) / 450 kPa

Flow capacity within the plane (NF EN ISO 12958) / $1.6 \times 10^3 \text{ m}^2/\text{s}$ ($i=1$; 20 kPa)

Packaging / Rolls 48 m long and 0.3 to 1 m wide.

Thickness (NF EN ISO 9863-1) / 5 mm

Compressive strength (NF EN ISO 25619-2) / 450 kPa

Flow capacity within the plane (NF EN ISO 12958) / $0.85 \times 10^3 \text{ m}^2/\text{s}$ ($i=1$; 20 kPa)

Packaging / Rolls 48 m long and 0.3 to 1.8 m wide.

Drainage geocomposite manufactured with a CFTR Technical Report, consisting of a geospacer completely wrapped in a certified geotextile. This geocomposite includes its own integrated collector (waterproofed channel). Its function is to collect and move water resurgences and seepage.

Certification / CFTR Technical Report pending

Thickness (NF EN ISO 9863-1) / 20 and 40 mm

Compressive strength (NF EN ISO 25619-2) / 200 kPa

Flow capacity within the plane (NF EN ISO 12958) / de 7×10^{-3} to $24 \times 10^{-3} \text{ m}^2/\text{s}$ ($i=1$; 20 kPa)

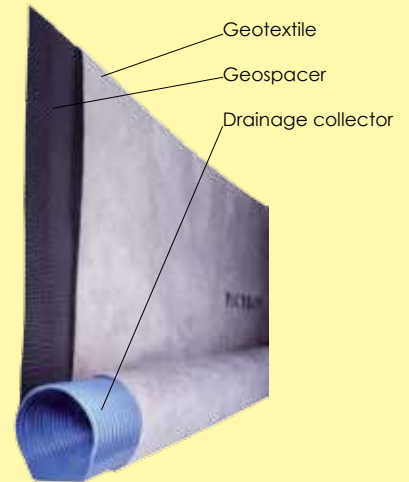
Packaging / Rolls 50 m long, 0.3 to 1.1 m wide

Roadside barrier

PACDRAIN

Performance

- THE GEOSPACER: Prevents all sideways water movement for complete reliability – high flow capacity and an waterproofed geospacer. Collects resurgences and removes the excess water at the interfaces of the structure and the road surface.
- THE GEOTEXTILE: An ASQUAL certified filter that completely covers the geospacer.
- THE DRAIN: Drainage collector as used in traditional drainage ditches, installed in a pocket.
- INSTALLATION: PACDRAIN can be installed manually or mechanically, and the excavated material is used for backfilling.



ROADRAIN



Performance

- THE GEOSPACER: Prevents all sideways water movement for complete reliability – high flow capacity and an waterproofed geospacer. Collects resurgences and removes the excess water at the interfaces of the structure and the road surface.
- THE GEOTEXTILE: An ASQUAL certified filter that completely covers the geospacer.
- THE DRAIN: Drainage collector as used in traditional drainage ditches, installed in a pocket.
- INSTALLATION: ROADRAIN can be installed manually or mechanically, and the excavated material is used for backfilling.

STABIDRAIN

Performance

- DRAINAGE BARRIER: Fitted with a chemically inert waterproofed core designed to transport water. The nominal drainage capacity of the product lengthwise is selected on the basis of the flow to be drained and the distance between outlets. The maximum drainage capacity of Stabidrain 40 at a gradient of 1% is 0.45 l/s under a pressure of 100 kPa. The long term mechanical strength (to EN ISO 1897) is 100 kPa or 10 t/m².
- THE GEOTEXTILE: An ASQUAL certified filter that completely wrapped the geospacer.
- INSTALLATION: Stabidrain is designed for use in earthworks and can be installed in a narrow ditch manually or mechanically, and the excavated material is used for backfilling.





Bridges and tunnels

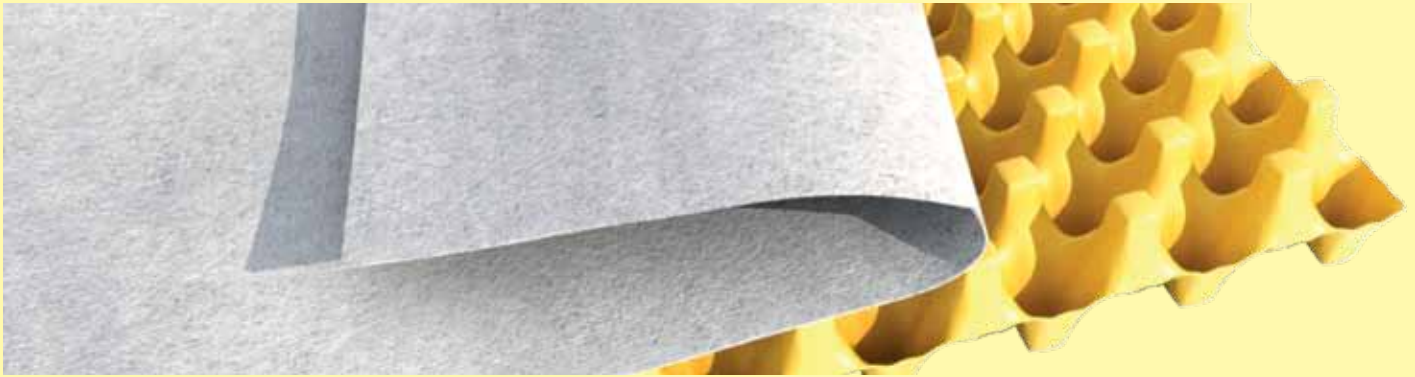
Bridges and tunnels must be built to last

Great care must be taken when designing drainage systems for bridge decks, roadways covered in porous asphalt or abutments, which must come with robust guarantees in terms of service life and effectiveness.

Bridge abutments/Cut-and-cover/Tunnel



Isocor (formerly Cordrain)



ISOCOR is a drainage geocomposite consisting of a thermoformed, symmetrical, waterproofed, non-compressible HDPE geospacer, thickness 8, 10 or 16 mm, attached to an ASQUAL certified geotextile on one side. ISOCOR performs four main functions: Filtration / Drainage on one side / Air gap along the wall / Waterproofed structure allowing the concrete to be sprayed or poured directly (formwork).

| Thickness (NF EN 964-1) / | 8 mm | 10 mm | 16 mm |
|--|---|---|---|
| Compressive strength (NF T 56-101) / | 150 kPa | 250 kPa | 450 kPa |
| Flow capacity within the plane (NF EN ISO 12958) / | $2.4 \times 10^{-3} \text{ m}^2/\text{s}$ (i=1; 50 kPa) | $3.1 \times 10^{-3} \text{ m}^2/\text{s}$ (i=1; 50 kPa) | $5.0 \times 10^{-3} \text{ m}^2/\text{s}$ (i=1; 50 kPa) |
| Installation depth / | 6 to 10 m | 10 to 16 m | 20 to 33 m |
| Packaging / | Width 1,100 or 2,200 mm, 25 m roll | Width 1,100 or 2,200 mm, 25 m roll | Width 1,100 or 2,200 mm, 25 m roll |

Bridges and tunnels

Porous asphalt



Asphadrain



ASPHADRAIN is a drainage geocomposite designed to drain seepage water under the permeable concrete on bridge decks and under porous asphalt.

ASPHADRAIN's hydraulic and mechanical properties mean it can be used to drain water from under road surfaces and on flyovers. It is very thick, has high compressive strength and is able to withstand high temperatures during installation.

In a drainage system for a bridge deck, ASPHADRAIN specifically collects and removes the drained water, preventing resurgences at the roadside.

| | |
|--|---|
| Thickness (NF EN 964-1) / | 16mm |
| Compressive strength (NF T 56-101) / | 750 kPa |
| Flow capacity within the plane (NF EN ISO 12958) / | $2.5 \times 10^{-3} \text{ m}^2/\text{s}$ ($i=1$; 20 kPa) |
| Packaging / | Width 60 mm (54 m roll) |



Ground consolidation

Vertical drainage for ground consolidation

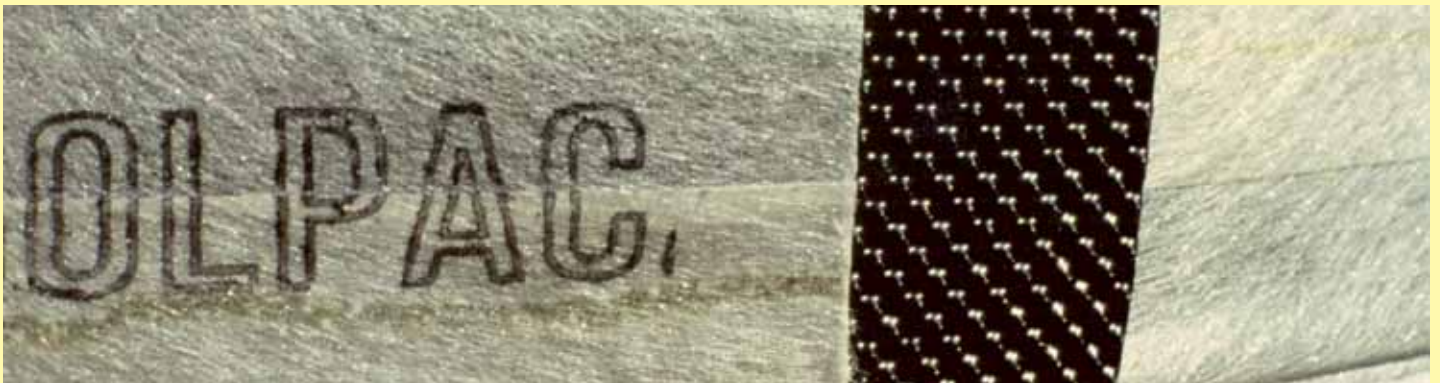
Vertical drainage is a technique that is used when structures are built on water saturated grounds.

In this situation, vertical drains make it easier to drain water. They also speed up the consolidation of compressible, waterlogged ground, reducing settling in future and increasing the shear strength of the ground.

Vertical drainage



Solpac



SOLPAC is a geocomposite drain consisting of two complementary elements – a central thermoformed structure made of HDPE, enclosed in a geosynthetic filter. This combination of features means that SOLPAC is an effective and reliable drain.

| | SOLPAC C533 | SOLPAC C633 |
|--|---|--|
| Thickness (NF EN ISO 9863-1) / | 5 mm | 6 mm |
| Compressive strength (NF EN ISO 25619-2) / | 450 kPa | 450 kPa |
| Flow capacity within the plane (NF EN ISO 12958) / | $0.8 \times 10^{-3} \text{ m}^2/\text{s}$ ($i=1$; 20 kPa) | $1.06 \times 10^{-3} \text{ m}^2/\text{s}$ ($i=1$; 20 kPa) |
| Discharge capacity 100 kPa (EN 15237) / | $6.58 \times 10^{-5} \text{ m}^3/\text{s}$ | $6.14 \times 10^{-5} \text{ m}^3/\text{s}$ |
| Packaging / | 200 m roll | 180 m roll |

Ground consolidation



Platform at Hamburg - Contractor MENARD - Nozay (France)

SOLPAC

Performance

- The increased crush resistance, along with a high discharge capacity, delivers high drainage flows during the preloading phase.
- The flexibility of the core makes it easy to use with the installation equipment, holds the product in position in the ground during pile driving, and also allows for faster installation.
- Thanks to its original thermoformed structure Solpac drain adjusts itself without punching when the ground settles
- The geotextile is an essential component which guarantees the durability of the drainage system during the consolidation phase. The mechanical and filtration properties can be sized according to the soil types encountered.
- The core and the geotextile are biologically inert and resistant to most chemical agents present in the ground.



REFERENCE PROJECTS

- TGV lines in France and Morocco
- Gdansk bypass in Poland
- Bergerac bypass
- Autoroute A63 at Bayonne
- Bordeaux bypass
- Platform at Hamburg

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