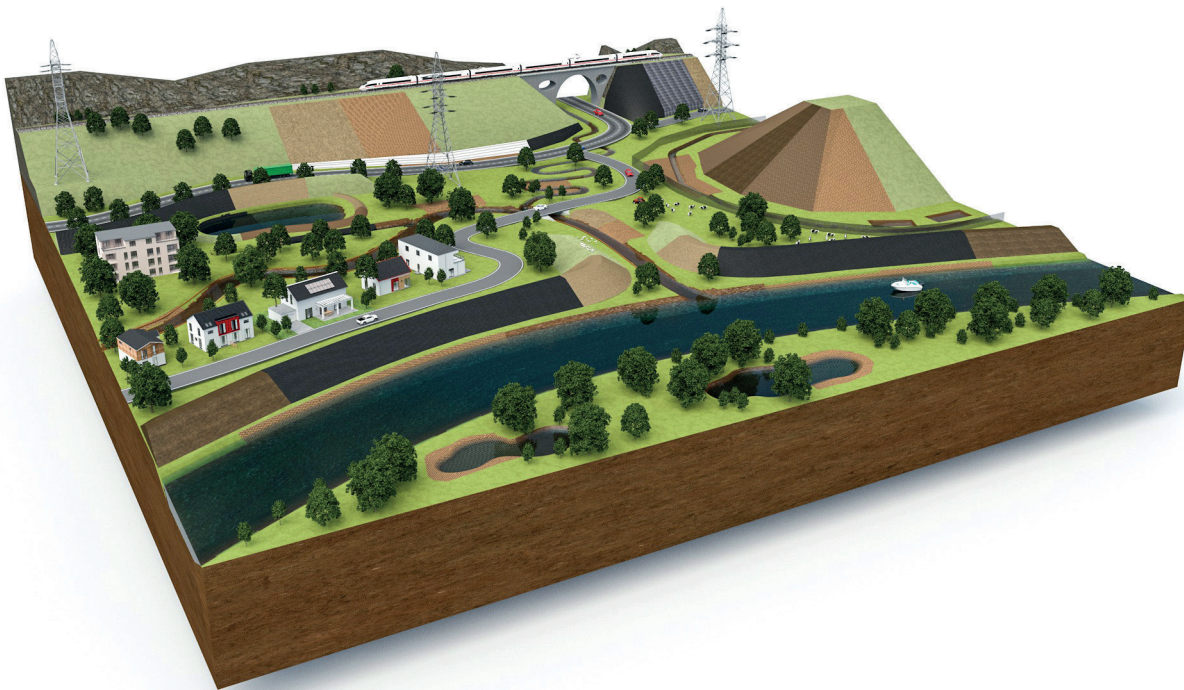


Secumat®

 Naue

Surface parallel erosion control



naue.com

Building on sustainable ground.

Surface parallel erosion control

Erosion

The risk of erosion

Application

The risk of erosion: Slope

The risk of erosion: Trench/Brook

Protection

Erosion control solutions

Product overview

Secumat® GreenLine

Flyer: Secumat® Green Jute N

Specification text: Secumat® Green Jute N 500 20x30

Flyer: Secumat® Green Coco M

Specification text: Secumat® Green Coco M 450

Flyer: Secumat® Green Coco R

Specification text: Secumat® Green Coco R 30

Flyer: Secumat® Green Coco N

Specification text: Secumat® Green Coco N 400 20x30

Specification text: Secumat® Green Coco N 700 15x20

Specification text: Secumat® Green Coco N 900 10x15

Flyer: Secumat® Green PinW

Secumat® ClassicLine

Flyer: Secumat® 3D Mesh

Specification text: Secumat® 401 G4

Specification text: Secumat® 601 G4

Specification text: Secumat® 401 20/20 Q1

Specification text: Secumat® 601 40/40 Q6

Specification text: Secumat® 601 201

Specification text: Secumat® 401 20/20 Q1 131C

Flyer: Secumat® Cell

Specification text: Secumat® Cell 100

Specification text: Secumat® Cell 150

Flyer: Secumat® PinU

Flyer: Secumat® Anchor

Project examples

Case Study: Erosion control in a drainage channel

Case Study: Erosion control of a car park trench

Case Study: Green Skin and Desert Skin solution for slopes

Technical information

Installation guideline

Appendix to installation guideline: Natural fibre products

Appendix to installation guideline: 3D Mesh products

Appendix to installation guideline: Earth Anchor system

Appendix to installation guideline: Geocell

Appendix to installation guideline: Georoll

Fixing options for Secumat® erosion control mats in different systems

The risk of erosion

Erosion – A real threat to our environment

Wind, water and ice shape the surface of our planet through erosion. Uncontrolled erosion is one of the greatest threats to our densely populated landscapes. Extreme weather events intensified by climate change cause stress for humans, flora and fauna and accelerate the change of the environment. Vegetation alone cannot always protect soils against exceptional erosion. Erosion phenomena occur on slopes, steep slopes, structures in water bodies on banks, in water transition zones, on lakes, in rivers and in the event of overflow. Both natural surfaces and surfaces of earthworks are affected, which means that a significant proportion of our infrastructure is at risk from erosion. Natural disasters have shown that urgent action is needed all over the world.



Fig. 1: Deflation



Fig. 2: Rill erosion



Fig. 3: Denudation



Fig. 4: Tunnel erosion

Erosion phenomena

1. Deflation – Detachment by wind or water

In deflation, the upper soil particles are loosened and transported by water or wind. This can contribute to desertification which is disadvantageous in terms of global warming as deserts heat up strongly and no water is retained which intensifies the trend. (Fig. 1)

2. Rill erosion – Formation of deep erosion rills

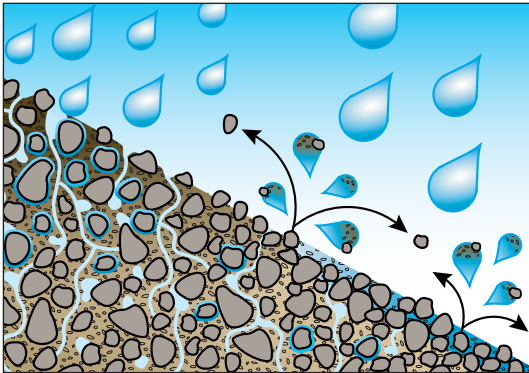
Rill erosion is primarily water-generated erosion in straight lines. Unpaved, sloping surfaces accelerate surface run-off which can lead to extremely deep erosion rills. This process is intensified if the rill cuts through a soil layer of carrying groundwater. This can lead to building structures being undercut in settlement areas, erosion damage to road/rail slopes as well as hydraulic structures, particularly due to overflowing and the subsequent large-scale movement of soil and deposition of silt (Fig. 2)

3. Denudation – Wearing away of the earth's surfaces

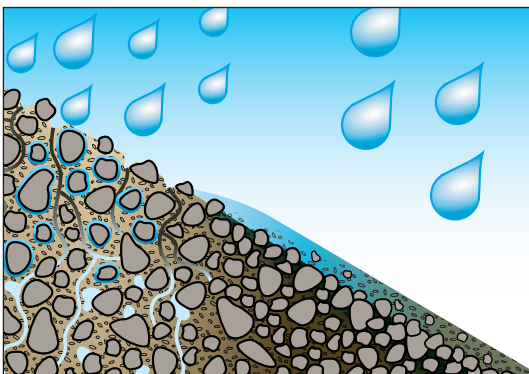
Denudation is the process of wearing away the earth's surfaces. It is a decisive factor in slippages or landslides when associated with soil on slopes. Soil softened by precipitation or backwater slides off higher areas and is deposited in alluvial zones. Sliding processes due to blocked and sodden layers of soil on steep slopes manifest as sudden mudslides, flows of debris (a flow of water-saturated mud and debris) and plaiks (slippage of grassland). (Fig. 3)

4. Tunnel erosion – Formation of cavities

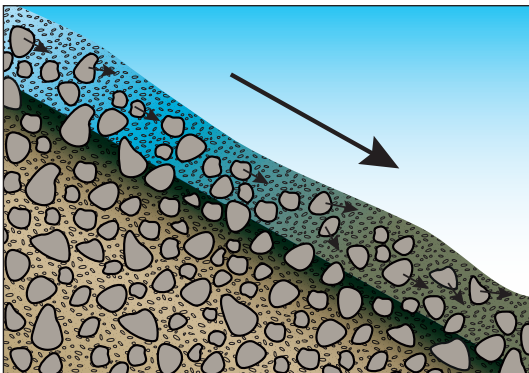
In tunnel erosion, cavities form in the soil. Water flows through the pores in the soil. Fine particles are loosened and discharged from these pores. If the discharge increases, the voids increase in size and the layer above can collapse. The failure and collapse of the upper layers lead to an immediate danger to life for road users. (Fig. 4)



Step 1: Soil aggregates are dissolved by intense precipitation



Step 2: Pores are blocked by clogging



Step 3: Surface run-off

The processes of erosion on slopes

Step 1

Particles of soil and soil aggregates are loosened, dissolved and moved by heavy precipitation or wind (deflation).

Step 2

The loosened and moved particles of soil are transported down the slope or over short or even longer distances in the direction of the wind. Wind erosion reduces vision.

The loosened fine particles clog the porous structure of the soil and reduce permeability. This leads to surface run-off which produces a flow down the slope which loosens and transports larger particles. The subsequent small flow seeks the path of least resistance and if necessary burrows deep into the surface (rill- and gully erosion).

Step 3

The surface run-off generate a an increasing flow whose shear stress loosens larger particles and transports these away. Softened soils are washed away (denudation).

→ For more information, see our flyer: “The risk of erosion: Slopes”

Significant damage to slopes

Erosion causes damage both on the relevant surface (On Site damage) and on other surfaces (Off Site damage). On Site damage reduces the soil thickness and cuts the soil profile. This affects the vegetation or structural components. Removal of On Site damage, if at all possible, requires the extremely expensive proposition of dealing with the surface of the slope later on.

Similarly, resolving Off Site damage is immensely time-consuming and can only be done in small steps and at considerable expense. Supporting natural erosion control with permanent or temporary Naue erosion control systems reduces this pattern of damage.

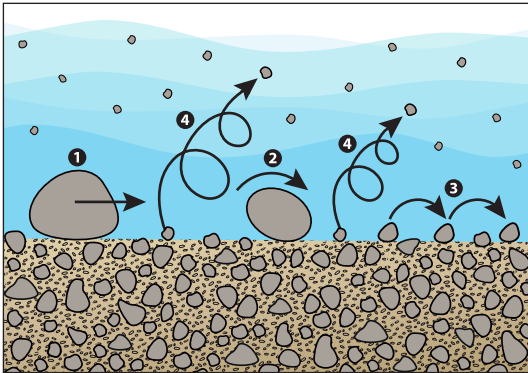


Fig. 5: Sediment transport

The processes of erosion in trenches and brooks

Transportation processes

The water moves the particles in the following four ways (Fig. 5):

- ❶ Reptation
- ❷ Rolling
- ❸ Saltation
- ❹ Suspension

The solid soil elements are moved with the water as a bed load on the stream bed while suspended particles are moved in the layer above this or dissolve in the water.

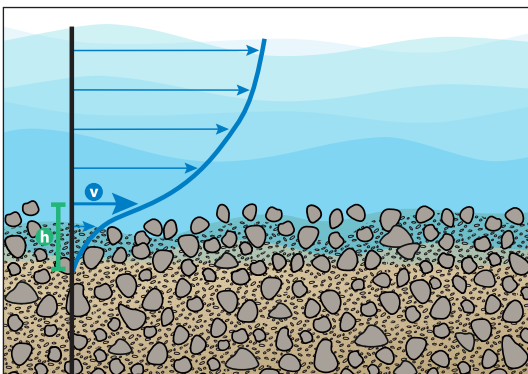


Fig. 6: Active Layer

Active Layer

The extent of transportation is largely dependent on the speed of flow and therefore the effective shear stress in the boundary layer to the sub-soil. The zone in the permeable soil which is directly influenced is known as the "Active Layer". Here, rearrangement processes take place first (Fig. 6).

- ❶ Flow speed
- ❷ Active Layer height

→ For more information, see our flyer: "The risk of erosion: Trench/Brook."

Influencing factors and solutions

Natural influencing factors are the soil condition, the intensity of precipitation, topography and vegetation. A further factor is humanity's intensive use of the surface of the Earth. Every construction project with unprotected soil surfaces is therefore potentially an extreme environmental intervention and the soil surface is therefore exposed to erosion.

Vegetation and cohesiveness or the mass of soil components can protect against erosive forces. If these protecting factors are not present, erosion control systems make a significant contribution to preventing erosion processes as they occur and to mitigate their consequences.

Installing Naue erosion control systems helps to stop erosion and subsequent damage. They are quick and easy to install making them a preferred solution.

The Naue Secumat® erosion control systems are geosynthetic systems for permanent solutions and are also available as natural fibre systems for temporary installations.



Fig. 1: Erosion due to precipitation

Erosion on slopes

Naue erosion control systems reduce the risk of erosion damage and the cost of resolving this. They also offer safety for people, animals, structures and nature. Risks can occur in various different applications.

Erosion can occur on flat slopes. In these instances, erosive precipitation or strong winds are enough if the soil is dried out and easy to detach. But prolonged, continuous precipitation also leads to erosion if the subsoil is silty, see Figure 1.

If the soil has been eroded, it is transported down the slope until the shear stress reduces. When the soil transport velocity is reduced this leads to a deceleration, resulting in deposition of the larger particles. The finer particles are transported on a wider distance up to the point of deposition at low flow rates, reduced shear stress and slower speed. This sorts the soil particles.

In general, two types of damage occur due to erosion, transportation and deposition: On Site and Off Site damage.

On Site and Off Site damage

1. On Site

The soil thickness decreases which reduces its capacity to retain water and storage nutrients. An open, unprotected soil surface is left behind which is more vulnerable to subsequent erosion. The uppermost soil layer/topsoil is unprotected.

2. Off Site

Neighbouring surfaces are damaged. The transported soil is displaced and covers plants, roads and buildings. The deposited material can be contaminated by pollutants and spreads in undesirable places. (Fig.2)

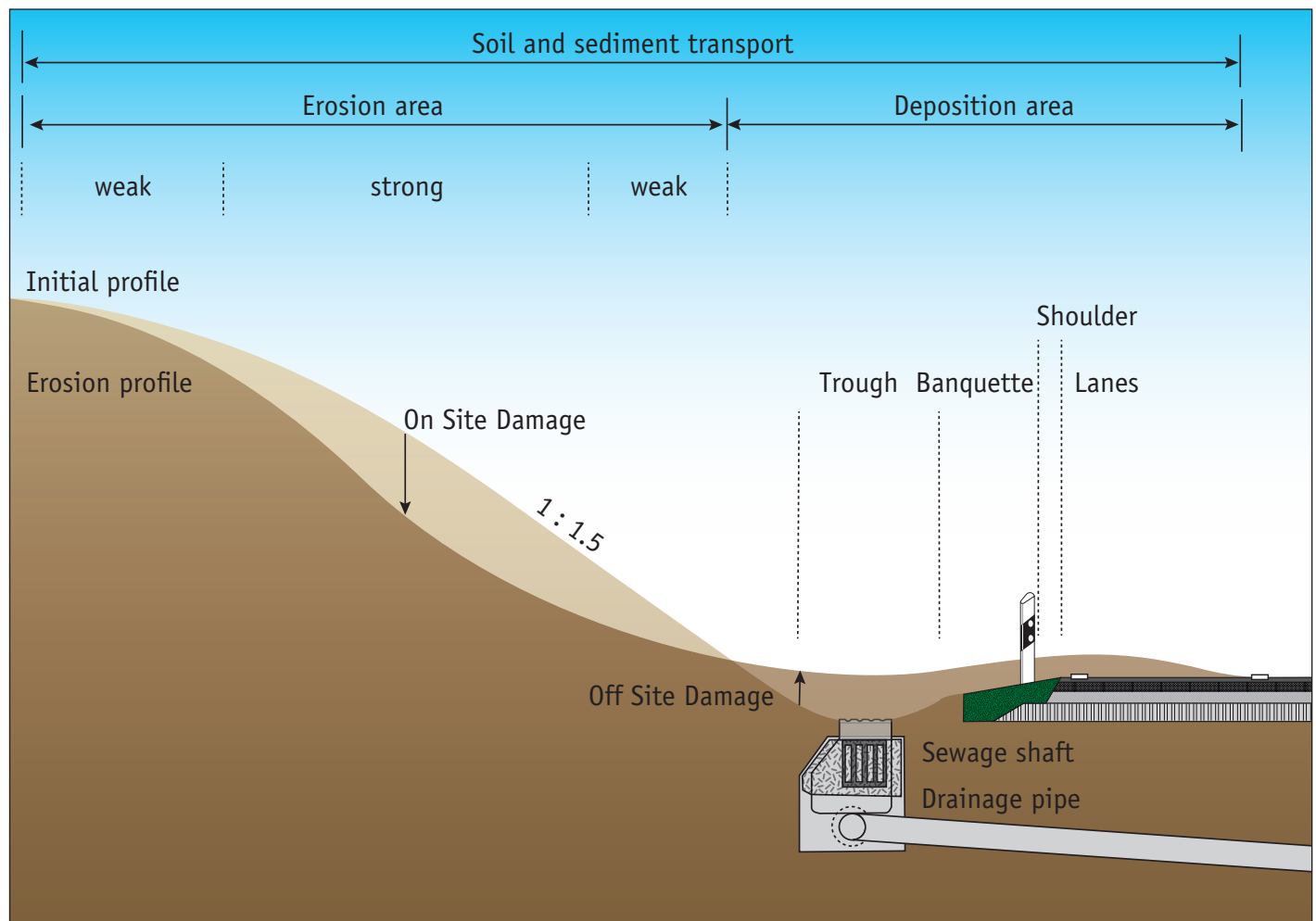


Fig. 2: On Site and Off Site damage



Fig. 3: Road collapse due to erosion damage

On Site, the transported soil particles are missing. This can lead to the following problems (Fig. 3):

- Structural stability (slope)
- Settlements (slope edges)
- Loss of function (overlying buildings)
- Larger vulnerable surfaces (progressive erosion)

Off Site, transported particles, whose movement is dependent on the transport energy, duration and direction of transportation, present the following off-site problems:

- Dirt depositing
- Clogging
- Silting
- Contamination

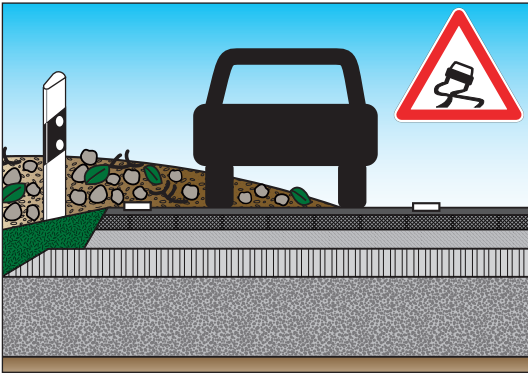


Fig. 4: Unwanted dirt

Dirt depositing

Above ground, roads are covered with displaced soil and dirt which can lead to slippery road surfaces. This increases the risk of accidents.

Soil particles displaced by wind drift and cloud in the air. This dusty aerosol can also increase the risk of accidents. (Fig. 4)

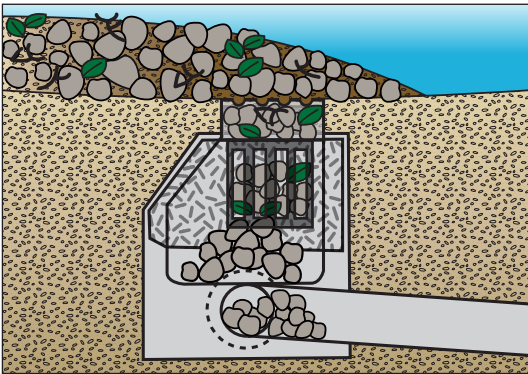


Fig. 5: Blocking of inlets

Clogging

Above-ground installations such as storm drains, shafts or gullies can become clogged and therefore unusable. Further precipitation cannot run off and its flow is no longer controlled. As a result, these installations can no longer perform their function. This situation can lead to high subsequent costs and permanently damage equipment and facilities. (Fig. 5)

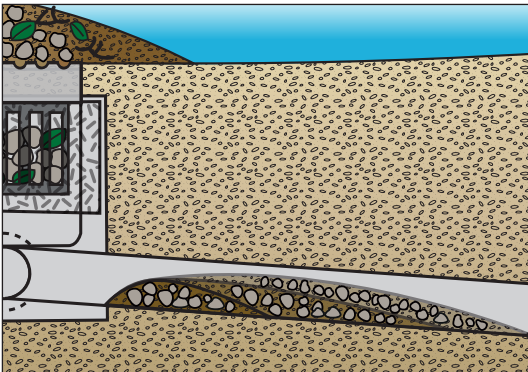


Fig. 6: Harmful flow reduction

Silting

Underground transportation channels can silt up, in this case a rain-water drainage pipe. Blocked pipework leads to an unpleasant back up and decreases drainage capacity. The ability of the separating or mixing system to drain must be maintained as far as this is possible as purification costs are included in wastewater charges. (Fig. 6)

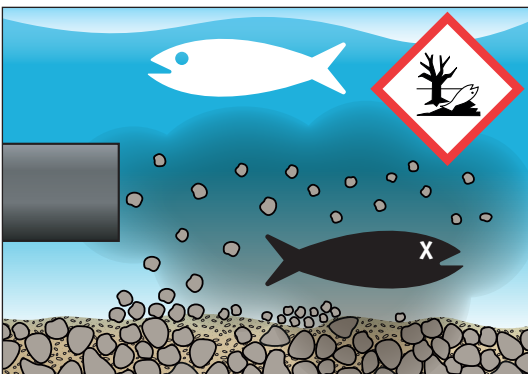


Fig. 7: Problems in the ecosystems

Contaminating

Fine sediments are transported into the receiving water on open stretches of water. The sediment can thus be contaminated by carried pollutants and this accumulates in locations where it is not welcome. Plants and organisms can have their equilibrium disturbed not only by the arrival of nutrients but also by turbidity, PH value, changes in temperature etc. leading to organism mortality and permanent damage to the ecosystem. (Fig. 7)

Naue erosion control systems reduce both On Site and Off Site damage.

The risk of erosion

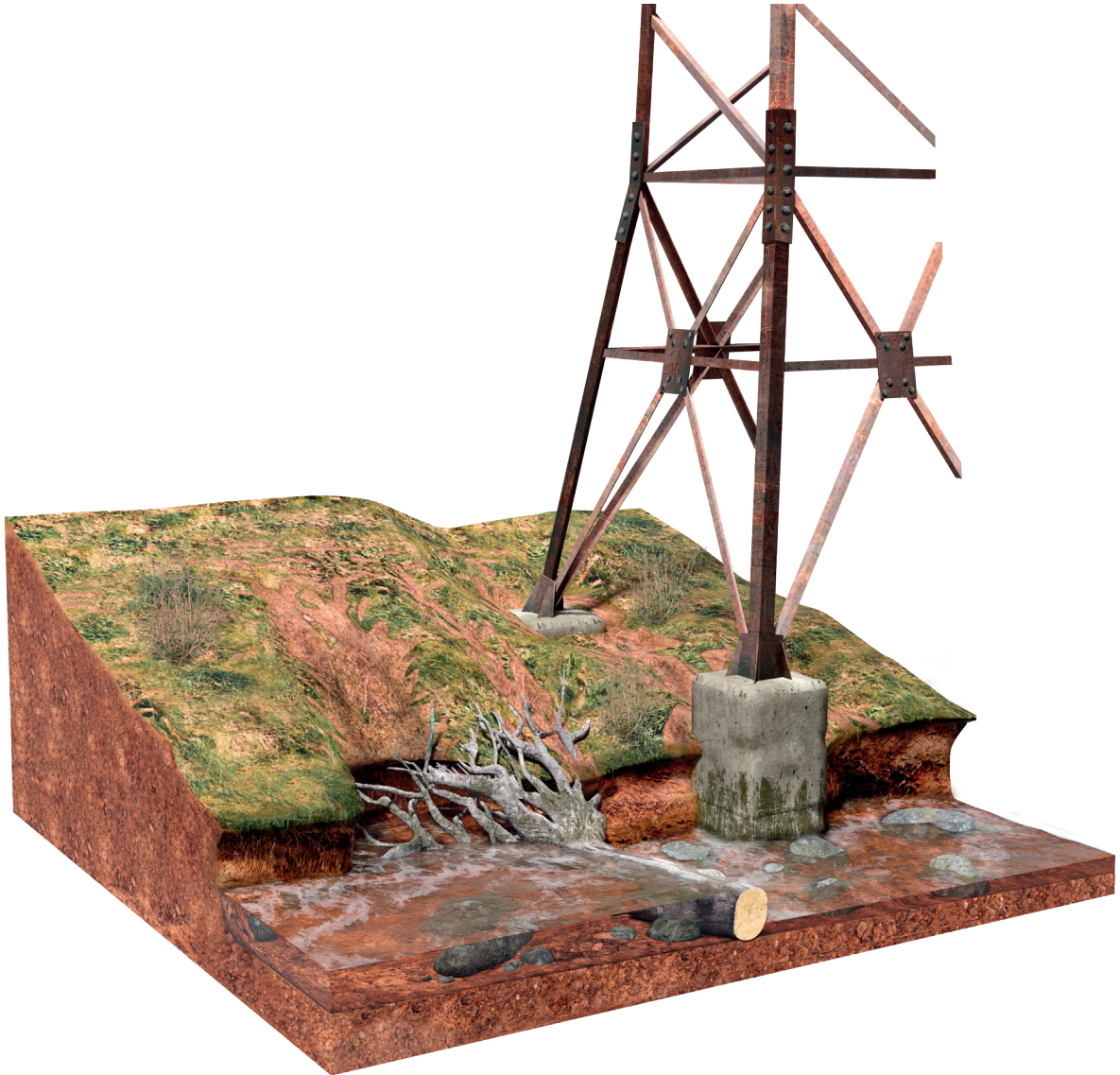


Fig. 1: Erosion due to uncontrolled incoming flow in trenches or brooks

Erosion in a trench or brook

Naue erosion control systems reduce the risk of erosion damage and the cost of resolving this. They also protect people, animals, structures and nature. Risks can occur in many different applications.

Erosion occurs even in small brook. Low shear stresses in the water are sufficient to transport the soil particles. The exposed particles which are also easy to transport are the first to move. (Fig. 1)

The particles which have been flushed away leave gaps which cause the bed to deepen as the rate of erosion increases. Different areas of flow form which spread laterally, thus affecting the banks. Heavy precipitation and flooding discharge run-off volumes of water which form beds. These transport more sediment downstream so that retrograde erosion strips out both the bed and the banks in rills without erosion control.

Bed and bank erosion due to sediment transportation

If the soil is eroded, it is transported downstream until the flow velocity or the shear stress reduces to below a critical value. The transportation velocity of the soil slows down which then leads to a deceleration and deposition of the larger sediment particles. With finer, smaller sediment particles, the velocity only decreases later as the critical shear stress is maintained for a longer time. This sorts the soil particles by size. The sorting can be clearly seen in nature. For example, finer particles are found in the mouth of the trench while the coarser particles are found in the upper reaches of the trench.

From an ecological perspective, a naturally or sustainably designed trench or brook with retention, floodplain and meadow areas is preferred. As a rule, straightened water bodies can rarely cope with heavy precipitation and flooding due to the defined flow velocity and therefore do not contribute to groundwater formation due to sealed beds and bank slopes and lack of still areas. (Fig. 2)

However, areas near trenches with vegetation can take on these tasks and also contribute to a thriving habitat which provides a space for insects and larger animals to inhabit.



Fig. 2: Undermined rail track

Active Layer

Where possible, the Active Layer should embed particles rather than release them. This counters erosion.

→ For more information, see the flyer “The risk of erosion”.

The reduction of this variable layer can result in six outcomes:

- Cross erosion of the bed
- Linear erosion of the bed
- Erosion on outer and inner bends
- Bank erosion
- Build-up of scouring
- Narrower rills due to deepening of the bed

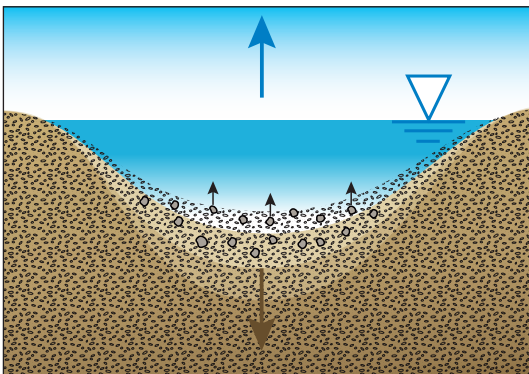


Fig. 3: Deepening of the bed

Cross erosion of the bed

The transportation of soil particles away from the brook bed causes the bed to deepen. This can be due to greater flow during heavy precipitation or at certain times of year due to high levels of run-off. Climate change is causing higher peak run-offs which can be either more localised or more frequent. Trench profiles are therefore exposed to significant effects which leads to changes in the morphology. (Fig. 3)

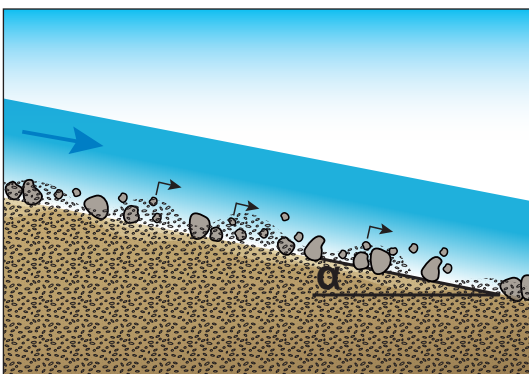


Fig. 4: Linear deepening of the trench

Linear erosion of the bed

The sediment is transported downstream. This deepens the bed along the entire length of the trench bed until the shear stresses decrease and the sediment is deposited. This deepening disrupts the equilibrium of the trench causing more soil particles to arrive from the upper course which leads to retrograde erosion of the trench bed. The deposition area can form at unfavourable points and destabilise the trench profile in these areas due to changes in the flow conditions. (Fig. 4)

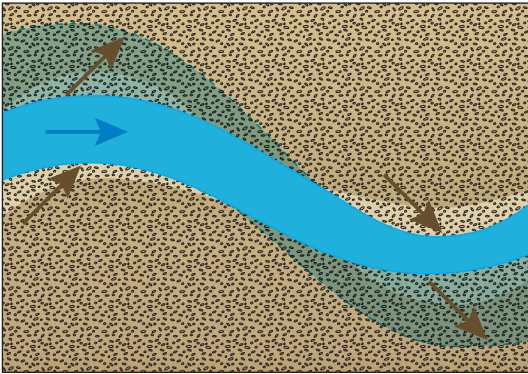


Fig. 5: Changes in course

Erosion on outer and inner bends

The increase in extreme flooding is leading to brooks changing their course. This can be critical if it affects discharge points, roads, footways or other constructions. This change of shape floods existing vegetation and fixed areas on the outer bends are eroded while particles are deposited on the inner bends. (Fig. 5)

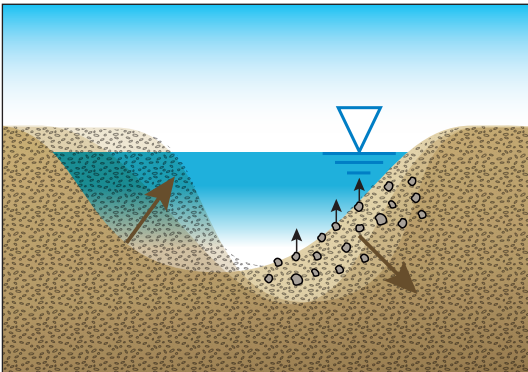


Fig. 6: Break-up and scouring of banks

Bank erosion

These displacements are associated with high water turbidity and deposition of contaminated fine particles transported by flooding. In the worst case, these can continuously release plumes of contamination into the water body in the direction of flow over time. (Fig. 6)

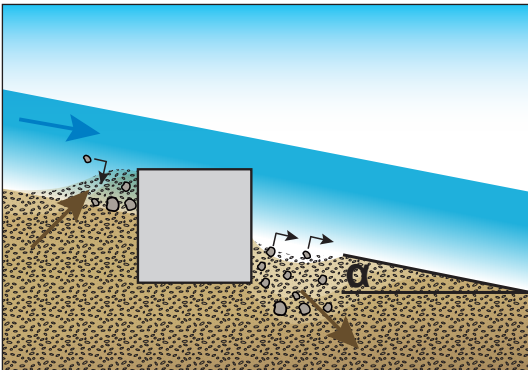


Fig. 7: Structures perpendicular to the direction of flow

Build-up of scouring

The soil particles accumulate upstream on structures perpendicular to the direction of flow and cause blockages. The sediment transported in the flow is missing downstream of the structure where it is eroded and removed. The erosion of the bed can reduce the stability of the structure. (Fig. 7)

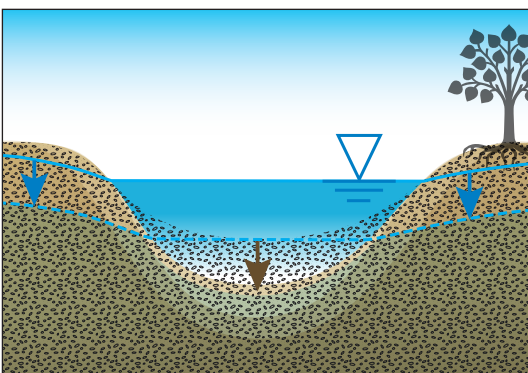


Fig. 8: Lowering the groundwater level

Narrower rills due to deepening of the bed

Groundwater is a resource to be protected. Increasingly extreme weather and progressive climate change are having a significant effect on groundwater which is regenerating more slowly. Add erosion close the surface to the equation and this effect is magnified as the infiltration is obstructed by the disruption to the soil structure and blockage of gaps in the space. Plants are no longer able to establish themselves in the water-rich layers and therefore waste away. Specifically, plant and soil regeneration slowly declines on the upper bank slopes so that, eventually, less water can infiltrate on a permanent basis. (Fig. 8)

Green and growing – Protection systems

Naue erosion control systems provide comprehensive protection against erosion phenomena in many different applications. They are used as both temporary and permanent erosion control. The erosion control components are part of the Secumat® range and provide active protection to prevent risks associated with erosion and their consequences.

Secumat® erosion control systems have been designed for many different applications including slopes, trenches and brooks, rivers, steep slopes or overflow. They consist of areal products and the relevant fixings which have been tailored to each other. The systems can be adapted to the most diverse project requirements.



Fig. 1: Slope with Secumat® Green Jute nets



Fig. 2: Soil reinforced with Secumat® Green coirmats



Fig. 3: Road slope with Secumat® geomats



Fig. 4: Trench bank with Secumat® combined geomats

Secumat® range

Secumat® erosion control systems protect in more than one way, see Figures 1 to 4. These different means of protection are a result of the products' specific characteristics and structures.

When correctly specified, Secumat® erosion control systems reduce the risk of undesired and sudden soil shift as a result of different types of erosion, particularly fine particles being blown away (deflation), removal of material over large areas (denudation), rill erosion, and tunnel erosion. When combined with Secugrid® soil reinforcement and stabilisation, it is possible to protect against natural hazards and damage and pronounced deflation and denudation effects, as well as rockfalls, mudslides and flows of debris. They support natural defence mechanisms provided by vegetative cover and security against exceptional occurrences.

The systems should be understood as integrated systems comprising the product and planting. This is an extension of the protection against surface erosion as defined in DIN EN ISO 10318 as preventing or limiting the movement of "soil or other particles ... at the surface". Vegetation supports the climate in the vicinity through infiltration capacity, shadowing, and the production of O₂. It also inhibits desertification and provides a supportive habitat for a wide variety of flora and fauna, see Fig. 4.

The high costs and significant amount of time required to eliminate erosion can be sustainably reduced by Naue erosion control systems.

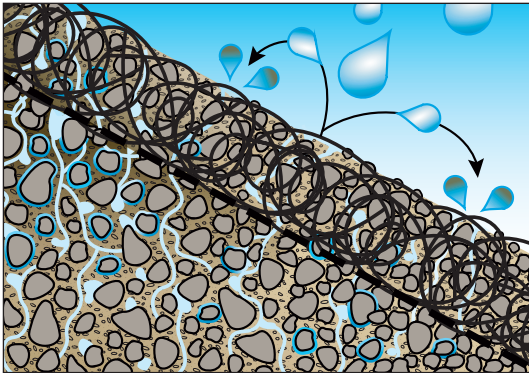


Fig. 5: Slope with Secumat® geomats with Rashel fabric (also available combined with Geogrid)

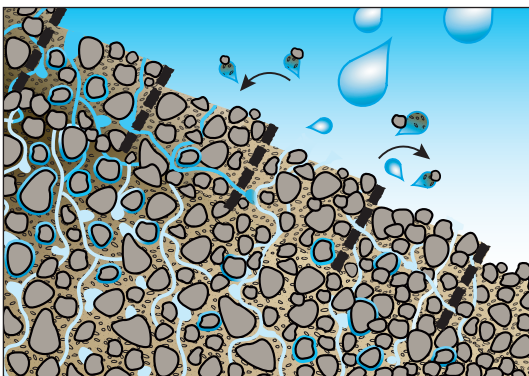


Fig. 6: Slope with Secumat® geocells

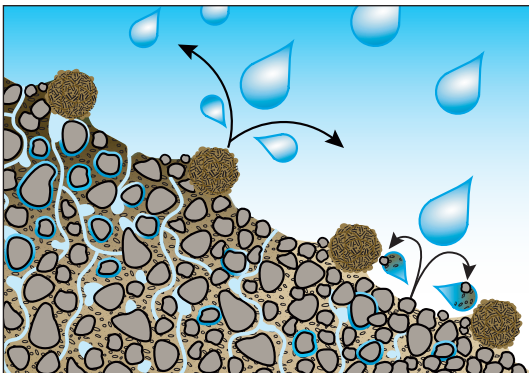


Fig. 7: Slope with Secumat® Green natural fibre nets

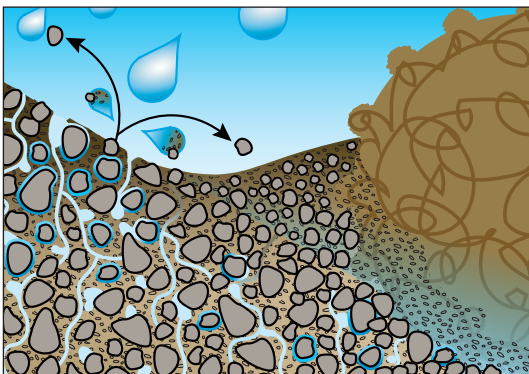


Fig. 8: Slope with Secumat® Green georolls

Protection against erosion on slopes

Naue erosion control systems are effective against rill erosion, tunnel erosion and sheet erosion. The Secumat® range of products reduces particle displacement and transportation on slopes or support particle consolidation or sedimentation.

Secumat® geomats reduce the impact force of precipitation and demonstrably improve infiltration, the volume of water infiltrating into the interception storage, the transitional storage, see Fig. 5.

The pockets of Secumat® geocells provide sufficient retention for different soils and roots. The cell walls stabilise the soil on slopes and ensure life of microorganisms, surface moisture and roots can penetrate through their generous openings. These rigid structures reduce displacement from changes in water content and temperature and thus prevent delicate roots from shrivelling due to dehydration, see Fig. 6.

Secumat® Green natural fibre products partially shadow the surface, store water and return it gradually to the planting. This reduces surface run-off while the vegetation establishes itself or reduces erosion energy and the disintegration of the soil conglomerates, see Fig. 7.

Secumat® Green georolls are used as individual, supplementary construction elements, as semi-permeable barriers to control a surface run-off, see Fig. 8.

Secumat® product group

Naue erosion control systems provide temporary and permanent erosion control for any application in the form of Secumat® products. This includes the Secumat® ClassicLine geocells, earth anchors and erosion control steel pins as well as combined 3D Mesh products. Secumat® GreenLine uses biodegradable areal products and wooden pins for fixing.

→ For more information, see our flyer: "The risk of erosion: Slopes."

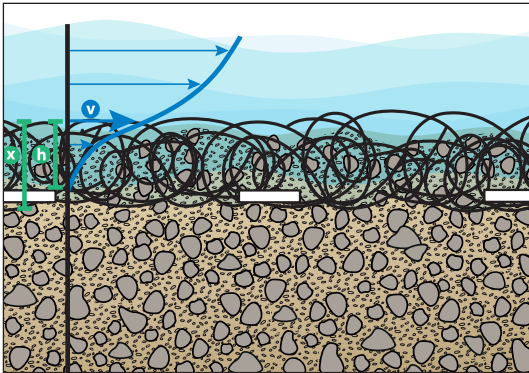


Fig. 9: Brook with Secumat® reinforced geomats

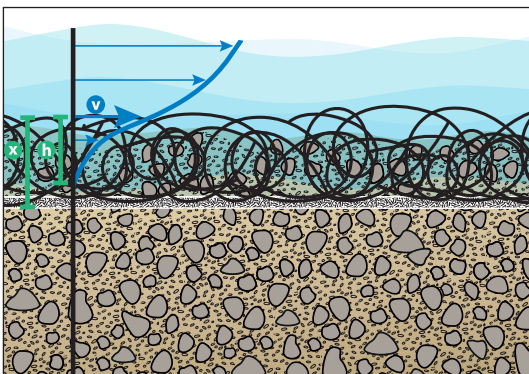


Fig. 10: Brook with Secumat® nonwoven combined geomats

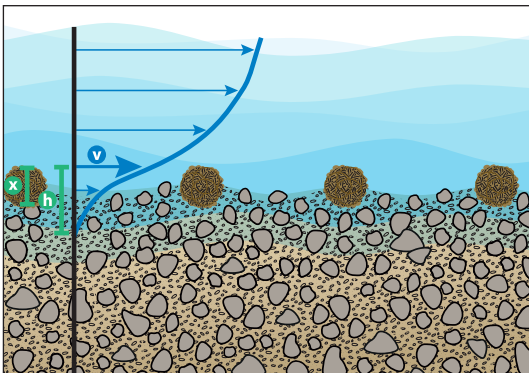


Fig. 11: Brook with Secumat® coir nets

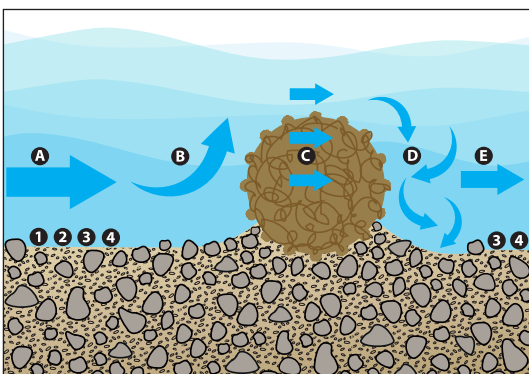


Fig. 12: Brook with Secumat® georolls

Protecting against erosion in trenches and brooks

Naue erosion control systems prevent deflation by fluids such as wind or water. In trenches and brooks, it is particularly important to create usable, permeable surfaces for flora and fauna around the water body which are as close as possible to nature and which fundamentally comply with ecological criteria e.g. the EU Water Framework Directive.

- Ⓥ Flow velocity profile
- ⓗ Active Layer height
- ⓧ Product height

Sediment is transported due to the shear stresses of the fluid and is indicated by the flow velocity v .

Geosynthetic products reduce the energy in the flow on the bed of trenches or brooks such that only smaller particles can be transported and provide space for sedimentation, see Fig. 9.

Geomat product combinations of 3D Mesh and Nonwoven components provide additional particle retention underneath the product by forming a particle barrier, see Fig. 10.

Natural fibre products reduce the flow velocity and support a wide range of hydraulics in the trench. The aim is to support the flow in the water body as well as the meso- and microhabitats, see Fig. 11.

Georolls allow the flow to be specifically adjusted and therefore provide water morphological process areas. The size of the individual semipermeable elements and the modified flow allow flow and cross-sectional forms, current shadows, scouring, fords and embankments to form. The resulting complex dynamic structural diversity drives extremely good ecological conditions in flowing water bodies, see Fig. 12.

Using georolls reduces the four processes of transportation of ① Repetition, ② Rolling, ③ Saltation and ④ Suspension. Large particles therefore move more less quickly or only smaller particles are transported by ③ Saltation and ④ Suspension. In addition, the inflow ① is changed as follows:

- Ⓐ Current flow
- Ⓑ Deflection
- Ⓒ Through flow
- Ⓓ Energy dissipation / vortex / low current flow
- Ⓔ Reduced flow velocity

→ For more information, see our flyer: "The risk of erosion: Trench/Brook."

Secumat® Green Jute N

 Naue

The biodegradable jute net



naue.com

Building on sustainable ground.

Secumat® Green Jute N is a sustainable, temporary erosion control solution. It comprises a warp (vertical) and weft (horizontal) woven net with displaceable openings in the net. It is made from 100% untreated jute fibres which have a natural variance in thickness when spun and is completely biodegradable.

Secumat® Green Jute N 500 20x30 acts as a simple means of supporting vegetation. It is used as a moisture depot and a shadowing to support initial vegetation and minimise erosion.

Typical applications for Secumat® Green Jute N

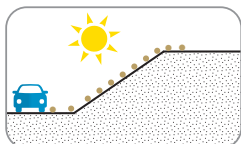


Figure 1:
Vegetating aid
for areal slopes

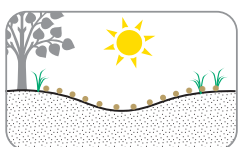


Figure 2:
Trough secured against
erosion with jute net

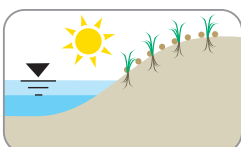


Figure 3:
Secumat® Green Jute N
on still water body

1. Vegetating aid for infrastructure

Secumat® Green Jute N is used in infrastructure projects to secure areal surfaces (gradient up to approx. 10°) where the threat of erosion is low. It is suitable for use wherever initial vegetation is to be supported for a period of no more than one year. The established plants protect and secure the slope against erosion. (Fig. 1)

2. Protecting troughs

Using Secumat® Green Jute N reduces the erosive effect of precipitation and promotes the water retention properties of the soil. The microclimate is also improved at the same time. The use of jute net can be a positive support for the water supply particularly in critical development phases such as during dry periods. (Fig. 2)

3. Protection against soil intrusion in still water bodies

Secumat® Green Jute N provides effective protection against unwanted soil intrusion on areal slopes above still water bodies. It is particularly suitable where the risk of erosion due to the soil properties and the topography is considered to be low.

By supporting initial vegetation during the germination phase, the jute net promotes rapid, near natural integration of the surface into the landscape. (Fig. 3)

Benefits of using Secumat® Green Jute N

Secumat® Green Jute N is a 100% biodegradable, areal erosion control product which is easy to install. A soil cover is not necessary.

The composition of the bast fibre means jute has a particularly high water absorbency. Jute nets are therefore particularly suitable for semi-arid areas where water-scarce phases follow short periods of precipitation. Secumat® Green Jute N acts as a water reservoir and gradually releases the water during the dry phases.

Secumat® Green Jute N supports initial vegetation during the germination phases, particularly in dicotyledons. These develop particularly quickly in the loose weave of the open-net jute fibres to form a continuous vegetative layer.



Figure 4: Secumat® Green PinW 30



Figure 5: Jute net with wooden pin



Figure 6: Baled jute nets



Figure 7: Secumat® Green Jute N 500 20x30

Benefits of Secumat® Green Jute N 500 20x30

- Secumat® Green Jute N is particularly cost-effective as it requires minimal maintenance and does not generate any disposal costs.
- It is particularly quick and easy to install and does not have to be covered.
- Jute nets can be used in many different applications with slope gradients of $< 10^\circ$.
- Secumat® Green Jute N 500 20x30 offers the ideal biodegradable solution for projects where the development of vegetation requires no more than 12 months until it is fully established.

Secumat® Green Jute N 500 20x30 packaging

Secumat® Green Jute N is delivered baled in ten panels:

Product	Property	Value
Secumat® Green Jute N 500 20x30	Weight per unit area	500 g/m ²
	Mesh size (Warp x Weft)	20 mm x 30 mm

Standard dimensions	Property	Value
Bale	Dimension (W x L x H)	0.4 x 1.3 x 0.6 m
	Total surface area	610 m ²
	Weight	305 kg
	Quantity	10 panels/bale
Panel	Dimension (W x L)	1.22 x 50 m
	Total surface area	61 m ²
	Weight	30.5 kg

We recommend fixing Secumat® Green Jute N 500 20x30 with Secumat® Green PinW 30 wooden pins. (Fig. 4)



Figure 8: Jute nets on a slope

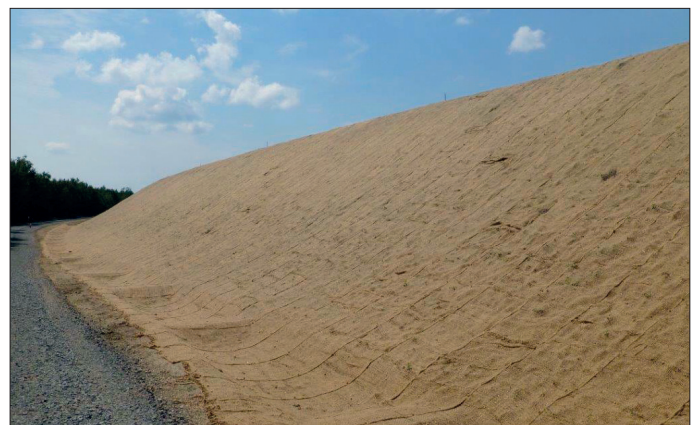


Figure 9: Jute nets as erosion control by a road



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naue.com

SPECIFICATION TEXT PROPOSAL

Secumat® Green Jute N 500 20x30

Pos.: Quantity: Unit Price: Total Price:

Jute fibre erosion control net, **Secumat® Green Jute N 500 20x30** or equivalent, made by Naue GmbH & Co. KG, used as an erosion control system. Function supply and installation according to design, layout plans and manufacturer's installation guidelines.

Secumat® Green Jute N 500 20x30 is a net-like jute fibre fabric for temporary application. It reduces soil erosion due to erosive precipitation, supports initial revegetation and acts as an interception storage.

Jute fibres are renewable raw materials and biodegradable. The product consists of double-twisted jute and is woven in warp (longitudinal direction) and weft (transverse direction) by plain weave. The jute net has variable and sliding meshes, ideal for advancing plant growth. The number of threads per direction, the shading percentage and the thread thickness offer an interplay of protection and greening potential. The risk of erosion is reduced by a positive water absorption capacity. At the same time, the product acts as an interception store (moisture depot) and gradually releases the water from the jute fibre.

The product is easy to handle and allows for quick and secure installation.

Quantities are based on the area to be covered. Material for overlapping and cut-off must be included.

The following parameters must be considered for proof of equivalency:

Technical Data:

Raw material:	Jute
Thread thickness:	approx. 2.65 mm
Amount of threads in warp (md) x weft (cmd):	40 x 35
Shadowing ratio (according to LB 2021-05-27-002):	approx. 50 %
Mass per unit area (according to DIN EN ISO 9864):	500 g/m ²
Tensile strength (md/cmd) (according to DIN EN ISO 10319):	7.5 / 5 kN/m
Mesh spacing from warp to warp (cmd)x Weft to weft (md):	20 x 30 mm

Panel Dimensions:

Width x Length: 1.22 m x 50 m

Weight: 30.5 kg

The following proofs must be submitted with the tender:

- Factory production control of the product

Optimal fixing:

The **Secumat® Green Jute N 500 20x30** should be secured to the ground with a wooden pin entitled **Secumat® Green PinW 30**.

Proof of Delivery (POD)
Secumat® Green Jute N 500 20x30

Naue GmbH & Co. KG
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Status: 07.12.2021

Secumat® Green Coco M

 Naue

The biodegradable coir mat



naue.com

Building on sustainable ground.

Secumat® Green Coco M is a sustainable, temporary erosion control solution. This coir fibre mat is quilted on both sides with a carrier made of jute fabric and jute fibres. The filling is 100% biodegradable, untreated coir fibre. The fibre structure acts as a separating and coarse filter layer and effectively reduced the erosive energy of precipitation and flowing water.

The Secumat® Green Coco M 450 coir filling also protects the vegetation growing underneath against significant temperature fluctuations and reduces evaporation of water close to the surface.

Typical applications for Secumat® Green Coco M

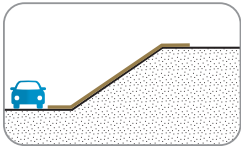


Figure 1:
Soil retention
on slopes

1. Vegetating slopes

Secumat® Green Coco M quickly establishes a natural appearance on slopes on infrastructure construction projects. Slope inclinations of up to 40° can be accommodated. Secumat® Green Coco M thus creates areas of biological diversification in urban environments. Habitats are generated for microorganisms such as insects and this contributes to improving the climate. (Fig. 1)

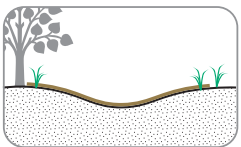


Figure 2:
Coir mats as vegetation
support in troughs

2. Trough vegetation

The closed surface of Secumat® Green Coco M provides more stable filtration and reliable soil retention which reduces the risk of soil erosion and supports initial greening. (Fig. 2)

3. Trickle protection in facing systems

Coir mats can also be used in facing systems. The Secumat® coir mat in the front of the facing provide trickle protection and facilitate vegetation for quick integration of the surface into the landscape. (Fig. 3)

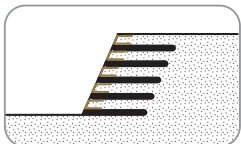


Figure 3:
Controlled water flow in
infrastructure projects

Benefits of using Secumat® Green Coco M

Secumat® Green Coco M is a 100% biodegradable, areal erosion control product which is easy to install. A soil cover is not necessary and there is no need for cost-intensive deconstruction.

A uniformly high quality is ensured due to the continuous mechanical production method. The high levels of lignin ensure the coir fibres break down slowly. The jute net enclosing the Secumat® Green Coco M provides high water absorbency which supports the moisture balance in the soil.

The gradual degradation of the different components results in a functional time up to 36 months which provides plants with more and more room in which to grow.



Figure 4: Secumat® Green PinW 30



Figure 5: Secumat® Green Coco M 450



Figure 6: Secumat® Green Coco M 450



Figure 7: Stacked rolls of coir mats

Benefits of Secumat® Green Coco M 450

- Secumat® Green Coco M 450 is particularly cost-effective as it requires minimal maintenance and does not generate any disposal costs.
- It is particularly quick and easy to install and does not have to be covered.
- Coir mats can be used in many different applications with slopes gradients of > 40°.
- It offers the ideal biodegradable solution for cases where the development of vegetation requires no more than 36 months until it is fully established.
- Secumat® Green Coco M 450 can therefore be used in a wide range of applications with a high level of safety.

Secumat® Green Coco M 450 packaging

Secumat® Green Coco M 450 coir mats are supplied in rolls:

Product	Property	Value
Secumat® Green Coco M 450	Weight per unit area	450 g/m ²
	Roll dimension (W x L)	2.4 m x 50 m

We recommend fixing Secumat® Green Coco M 450 with Secumat® Green PinW 30 wooden pins. (Fig. 4)



Figure 8: Coir mats on a slope



Figure 9: Coir mats as facing



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naue.com

SPECIFICATION TEXT PROPOSAL

Secumat® Green Coco M 450

Pos.: Quantity: Unit Price: Total Price:

Coconut fibre erosion control mat, **Secumat® Green Coco M 450** or equivalent, made by Naue GmbH & Co. KG, used as an erosion control system. Function supply and installation according to design, layout plans and manufacturer's installation guidelines.

Secumat® Green Coco M 450 is a quilted coconut fibre fabric for temporary application. It reduces soil erosion due to erosive precipitation and supports initial revegetation. Coir and jute are renewable resources and biodegradable. The product consists of a coconut fibre inlay, held by a jute backing and a jute cover fabric and is connected with jute quilting threads.

The coir mat retards surface runoff and reduces soil erosion. This is ideal for advancing plant growth in the seedling and vegetative stages. The mat structure, mass per unit area and layer thickness increases the potential for revegetation. Water is absorbed in the jute threads and released again with a time delay. The coconut fibres have a positive influence on the nutrient balance. The product is easy to handle and enables quick and simple installation.

Quantities are based on the area to be covered. Material for overlapping and cut-off must be included.

The following parameters must be considered for proof of equivalency:

Technical Data:

Raw material:	Coir/ Jute
Thickness (according to DIN EN ISO 9863-1):	10.0 mm
Mass per unit area (according to DIN EN ISO 9864):	450 g/m ²
Tensile strength (md/cmd) (according to DIN EN ISO 10319):	4.2 kN/m / 3.7 kN/m

Roll Dimensions:

Width x Length:	2.40 m x 50 m
Diameter:	38 - 40 cm
Weight:	54 kg

The following proofs must be submitted with the tender:

- Factory production control of the product

Optimal fixing:

The **Secumat® Green Coco M 450** should be secured to the ground with a wooden pin entitled **Secumat® Green PinW 30**.

**Proof of Delivery (POD)
Secumat® Green Coco M 450**

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Status: 07.12.2021

Secumat® Green Coco R

 Naue

The biodegradable georoll



naue.com

Building on sustainable ground.

Secumat® Green Coco R is a sustainable, temporary erosion control solution of a georoll. It comprises a securely knotted netting tube made from mechanically twisted coir twins which is filled with untreated coir fibres.

The Secumat® Green Coco R 30 georolls are always used as finished components where bank fascines or reed rolls cannot cope with the requirements, for example, when securing the foot of a slope or for temporary interventions in the event of transportation of debris and regulating running water.

Typical applications for Secumat® Green Coco R

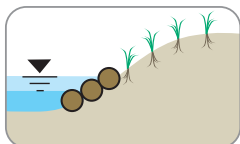


Figure 1:
Controlled water flow in
infrastructure projects

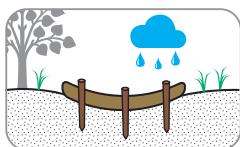


Figure 2:
Coir rolls as vegetation
support in troughs

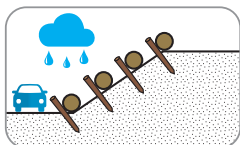


Figure 3:
Supporting vegetation
on infrastructure

1. Securing trench/brook slopes

Secumat® Green Coco R provides erosion control in the water transition zone. The coir roll offers natural support for slopes, particularly in flowing or still water bodies. It can provide rapid repair of scouring, undercutting, or riparian vegetation. Secumat® Green Coco R georolls can be installed in several layers on top of each other or perpendicular to the direction of flow on a layer of brushwood arranged with its ends extending vertical into the flow. (Fig. 1)

2. Trough vegetation

The coir rolls slow down surface water from precipitation and allow it to percolate slowly into the soil. At the same time, they encourage deposition of entrained debris. In this type of application, Secumat® Green Coco R georolls are arranged one behind the other. (Fig. 2)

3. Vegetating slopes

Coir rolls quickly establish a natural appearance on slopes on infrastructure construction projects. Precipitation is infiltrated into the soil close to the surface and soil slides are averted, particularly when there is a greater build-up of mud due to erosion. Secumat® Green Coco R also creates areas of biological diversity in urban environments. This creates habitats for microorganisms such as insects which helps improve the climate. We recommend this product installed with a flat natural fibre product such as Secumat® Green Coco M/N. (Fig.3)

Benefits of using Secumat® Green Coco R 30

Secumat® Green Coco R is a 100% biodegradable erosion control product supplied as rolls. The georolls can be installed at any time and in just a few steps. There is no need for cost-intensive deconstruction, particularly where stream and river courses vary.

Due to its compact design and the high lignin content of coir fibres, Secumat® Green Coco R degrades slowly and therefore has a service life of up to 60 months. The coir rolls control erosion phenomena for long periods until an equilibrium between plant cover and deposition has been established.

The georolls start working as a sediment trap as soon as they are installed. They therefore provide quick and secure erosion control, for example, in flowing water bodies.



2

Figure 4: Secumat® Green Coco R 30



Figure 5: Flexible georoll for curved installation



Figure 6: Georolls stacked at the edge of the bank with wooden stakes



Figure 7: Bundled Secumat® Green Coco R 30

Benefits of Secumat® Green Coco R 30

- Secumat® Green Coco R 30 coir rolls are particularly cost-effective as they require minimal maintenance and do not generate any disposal costs.
- They allow water to drain through while retaining soil particles at the same time. Extremely fine suspended particles are therefore retained and filtered in the georoll so that water turbidity and silting of the trench/brook bed is avoided.

Secumat® Green Coco R 30 packaging

Secumat® Green Coco R 30 coir rolls are supplied bundled:

Product	Property	Value
Secumat® Green Coco R 30	Weight	25.5 kg
	Dimension (D x L)	0.3 m x 3 m
	Mesh size (knotted Warp x Weft)	50 mm x 50 mm
	Density	125 kg/m ³

Secumat® Green Coco R 30 should be fixed in place using standard wooden stakes provided for this purpose. Further information is available in our installation instructions for georolls.



Figure 8: Georolls in a trench



Figure 9: Georolls parallel to the slope



SPECIFICATION TEXT PROPOSAL

Secumat® Green Coco R 30

Pos.: Quantity: Unit Price: Total Price:

Coconut fibre erosion control roll, **Secumat® Green Coco R 30** or equivalent, made by Naue GmbH & Co. KG, used as an erosion control system. Function supply and installation according to design, layout plans and manufacturer's installation guidelines.

Secumat® Green Coco R 30 is a roller-like coconut fibre roll for temporary application. It reduces the carry-over of soil particles that have started to move as a result of erosive precipitation.

On slopes, the roller reinforces the base of the slope and acts as a greening aid.

In the channel, it reduces the flow as a sill, is used for rapid scour repair, as a sediment and sand trap, for bank renaturation, restoration and re-contouring.

Coconut fibres are renewable raw materials and biodegradable. The two-part product consists of a stuffed coconut fibre filling surrounded by a machine twisted coconut fibre net. The coir fibre net consists of coir double twine and is linked in warp (longitudinal direction) and weft (transverse direction) by knot-fixed rhombic meshes. The coir filling remains in the product when water penetrates and retains soil particles. Here, the fibre length, density and roller diameter ensure positive sediment retention. The product is easy to handle and allows for quick and easy installation.

Quantities are based on the area to be covered. Material for overlapping and cut-off must be included.

The following parameters must be considered for proof of equivalency:

Technical Data:

Raw material:	Coir
Thread thickness:	150 mm
Roll density:	approx. 125 kg/m ³
Roll diameter (according to DIN EN ISO 9863-1):	30 cm
Mesh spacing from warp to warp (cmd)x Weft to weft (md) with knots:	50 mm x 50 mm
Mass per unit area (according to DIN EN ISO 9864):	8.5 kg/m

Roll Dimension:

Width x Length:	0.3 m x 3 m
Diameter:	30 cm
Weight:	25.5 kg

The following proofs must be submitted with the tender:

- Factory production control of the product

Optimal fixing:

The **Secumat® Green Coco R 30** is to be fixed in the ground with an anchoring system according to the project-specific requirements or according to the manufacturer's installation instructions. Wooden piles (to be provided by the customer; e.g. impregnated, sharpened hardwood; diameter ≥ 6 cm; length ≥ 2 x roller height, unless otherwise defined for the project) are to be installed for the fastening in accordance with the installation instructions.

Proof of Delivery (POD)
Secumat® Green Coco R 30
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www.naue.com

Status: 14.01.2022

Secumat® Green Coco N

 Naue

The biodegradable coir nets



naue.com

Building on sustainable ground.

Secumat® Green Coco N is a sustainable, temporary erosion control solution. It comprises a two-ply, 100% untreated coir fibre which is mechanically woven into a net in the warp and weft and is completely biodegradable.

Secumat® Green Coco N thus delays surface run-off and stabilises the surface of the soil, significantly reducing the risk of soil erosion. We have three variants of coir net which means we can meet many different project requirements in terms of tensile strength and service life.

Typical applications for Secumat® Green Coco N

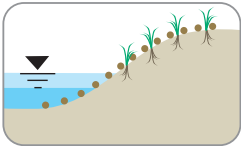


Figure 1:
Supporting vegetation
on trenches/brooks

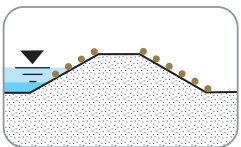


Figure 2:
Coir nets on dykes

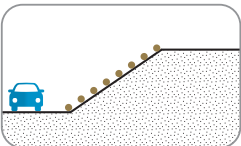


Figure 3:
Controlled water run-off
in infrastructure projects

1. Vegetating trench/brook slopes

Secumat® Green Coco N facilitates vegetation in water transition zones. Temporary designs for natural embankments using coir nets can support initial vegetation, particularly in flowing and stationary bodies of water. The established plants protect and secure the slope against erosion. (Fig. 1)

2. Vegetating dykes

Certain constructions, such as dykes which are attacked by wave action during the greening phase, can be secured against surface erosion with Secumat® Green Coco N. In this case, the coir net acts as a preventative retention to counter retrograde erosion as it moderates the erosive precipitation, thus supporting a uniformly dense layer of turf. (Fig. 2)

3. Securing and vegetating infrastructure slopes

Coir nets quickly establish a natural appearance on slopes on infrastructure construction projects. Seepage of precipitation into the upper soil is encouraged and soil slippage due to erosion averted. Secumat® Green Coco N thus creates areas of biological diversity in urban environments. Habitats for microorganisms quickly form in the net structure and thus support rapid establishment of diversified flora and fauna. By storing moisture and reducing erosion, the microclimate is improved. (Fig. 3)

Benefits of using Secumat® Green Coco N

Secumat® Green Coco N is a 100% biodegradable, areal erosion control product which is easy to install. A soil cover is not necessary.

A uniformly high quality and service life is ensured due to the continuous mechanical production method. The naturally high levels of lignin encourage the coir fibre to break down slowly. The high tensile strength of the fibres gives Secumat® Green Coco N a high structural strength and the net thus protects against erosion for long periods.

The special structure of Secumat® Green Coco nets net reduces surface run-off. The individual threads of the web slow down precipitation water and flowing bodies of water thus protecting the soil surface from erosion. The coir net also supports the growth of young plants.



2 Figure 4: Secumat® Green PinW 30



Figure 5: Installing the coir net with wooden fixings



Figure 6: Secumat® Green Coco N 400 20x30



Figure 7: Secumat® Green Coco N 900 10x15

Benefits of Secumat® Green Coco N

- Secumat® Green Coco N is particularly cost-effective as it requires minimal maintenance and does not generate any disposal costs.
- It is particularly quick and easy to install and does not have to be covered.
- The coir net can be used in many different applications with slopes gradients of > 35°.
- It offers the ideal biodegradable solution for cases where the development of vegetation requires more than 12 months until it is fully established.
- Secumat® Green Coco N can be safely used in a wide range of applications.

Secumat® Green Coco N variants

Die Secumat® Green Coco N products are available in the following weights per unit area:

Product	Property	Value
Secumat® Green Coco N 400 20x30	Weight per unit area	400 g/m ²
	Mesh size (Warp x Weft)	20 mm x 30 mm
	Roll dimensions (L x W)	2 m x 50 m
Secumat® Green Coco N 700 15x20	Weight per unit area	700 g/m ²
	Mesh size (Warp x Weft)	15 mm x 20 mm
	Roll dimensions (L x W)	2 m x 50 m
Secumat® Green Coco N 900 10x15	Weight per unit area	900 g/m ²
	Mesh size (Warp x Weft)	10 mm x 15 mm
	Roll dimensions (L x W)	2 m x 50 m

Secumat® Green Coco N is preferably secured using Secumat® Green PinW 30. (Fig. 4)



Figure 8: Coir nets in trenches and brooks



Figure 9: Coir nets on a slope

Approvals for the Naue Group



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naue.com

SPECIFICATION TEXT PROPOSAL

Secumat® Green Coco N 400 20x30

Pos.: Quantity: Unit Price: Total Price:

Coconut fibre erosion control net, **Secumat® Green Coco N 400 20x30** or equivalent, made by Naue GmbH & Co. KG, used as an erosion control system. Function supply and installation according to design, layout plans and manufacturer's installation guidelines.

Secumat® Green Coco N 400 20x30 is a net-like coconut fibre woven for temporary application. It reduces soil erosion due to erosive precipitation and supports initial revegetation.

Coconut fibres are renewable raw materials and biodegradable. The machine twisted product consists of coir two-ply and is mechanically woven in warp (longitudinal direction) and weft (transverse direction) by plain weave. The coir net has variable and sliding meshes, ideal for advancing plant growth. The number of threads per direction, the shading percentage and the thread thickness offer a combination of protection and greening potential. The product is easy to handle and enables quick and secure installation.

Quantities are based on the area to be covered. Material for overlapping and cut-off must be included.

The following parameters must be considered for proof of equivalency:

Technical Data:

Raw material:	Coir
Thread thickness:	4.0 mm
Amount of threads in warp (md) x weft (cmd):	40 x 35
Shadowing ratio (according to LB 2021-05-27-002):	approx. 40 %
Mass per unit area (according to DIN EN ISO 9864):	400 g/m ²
Tensile strength (md/cmd) (according to DIN EN ISO 10319):	9.9 kN/m / 10 kN/m
Mesh spacing from warp to warp (cmd)x Weft to weft (md):	20 mm x 30 mm

Roll Dimensions:

Width x Length: 2.00 m x 50 m

Diameter: 35 - 40 cm

Weight: 40 kg

The following proofs must be submitted with the tender:

- Factory production control of the product

Optimal fixing:

The **Secumat® Green Coco N 400 20x30** should be secured to the ground with a wooden pin entitled **Secumat® Green PinW 30**.

Proof of Delivery (POD)

Secumat® Green Coco N 400 20x30

Naue GmbH & Co. KG

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Status: 07.12.2021

SPECIFICATION TEXT PROPOSAL

Secumat® Green Coco N 700 15x20

Pos.: Quantity: Unit Price: Total Price:

Coconut fibre erosion control net, **Secumat® Green Coco N 700 15x20** or equivalent, made by Naue GmbH & Co. KG, used as an erosion control system. Function supply and installation according to design, layout plans and manufacturer's installation guideline.

Secumat® Green Coco N 700 15x20 is a net-like coconut fibre woven for temporary application. It reduces soil erosion due to erosive precipitation and supports initial revegetation as well as the growth of plants and their root structure.

Coconut fibres are renewable raw materials and biodegradable. The machine twisted product consists of coir two-ply and is mechanically woven in warp (longitudinal direction) and weft (transverse direction) by plain weave. The coir net has variable and sliding meshes, ideal for advancing plant growth in the seedling stage and in the vegetative phase. The number of threads per direction, the shading percentage, the mesh size and the thread thickness offer a combination of protection and greening potential. It protects the soil structure against rainfall erosion, delays water run-off above the soil surface and enriches the nutrient content in the soil. The product is easy to handle and enables quick and secure installation.

Quantities are based on the area to be covered. Material for overlapping and cut-off must be included.

The following parameters must be considered for proof of equivalency:

Technical Data:

Raw material:	Coir
Thread thickness:	4.5 mm
Amount of threads in warp (md) x weft (cmd):	60 x 50
Shadowing ratio (according to LB 2021-05-27-002):	approx. 60 %
Mass per unit area (according to DIN EN ISO 9864):	700 g/m ²
Tensile strength (md/cmd)	

(according to DIN EN ISO 10319):

17.9 kN/m / 11.2 kN/m

Mesh spacing from warp to warp (cmd)x

Weft to weft (md):

15 mm x 20 mm

Roll Dimensions:

Width x Length:

2.00 m x 50 m

Diameter:

40 - 45 cm

Weight:

70 kg

The following proofs must be submitted with the tender:

- Factory production control of the product

Optimal fixing:

The **Secumat® Green Coco N 700 15x20** should be secured to the ground with a wooden pin entitled **Secumat® Green PinW 30**.

Proof of Delivery (POD)

Secumat® Green Coco N 700 15x20

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Status: 07.12.2021

SPECIFICATION TEXT PROPOSAL

Secumat® Green Coco N 900 10x15

Pos.: Quantity: Unit Price: Total Price:

Coconut fibre erosion control net, **Secumat® Green Coco N 900 10x15** or equivalent, made by Naue GmbH & Co. KG, used as an erosion control system. Function supply and installation according to design, layout plans and manufacturer's installation guidelines.

Secumat® Green Coco N 900 10x15 is a net-like coconut fibre woven for temporary application. It reduces soil erosion due to erosive precipitation and supports initial revegetation as well as the growth of plants and their root structure.

Coconut fibres are renewable raw materials and biodegradable. The machine twisted product consists of coir two-ply and is mechanically woven in warp (longitudinal direction) and weft (transverse direction) by plain weave. The coir net has variable and sliding meshes, ideal for advancing plant growth in the seedling stage and in the vegetative phase. The number of threads per direction, the shading percentage, the mesh size and the thread thickness offer a combination of protection and greening potential. It protects the soil structure against rainfall erosion, delays water run-off above the soil surface and enriches the nutrient content in the soil. The product is easy to handle and enables quick and secure installation.

Quantities are based on the area to be covered. Material for overlapping and cut-off must be included.

The following parameters must be considered for proof of equivalency:

Technical Data:

Raw material:	Coir
Thread thickness:	5.0 mm
Amount of threads in warp (md) x weft (cmd):	70 x 60
Shadowing ratio (according to LB 2021-05-27-002):	approx. 80 %
Mass per unit area (according to DIN EN ISO 9864):	900 g/m ²
Tensile strength (md/cmd)	

(according to DIN EN ISO 10319):

19.2 kN/m / 17.3 kN/m

Mesh spacing from warp to warp (cmd)x

Weft to weft (md):

10 mm x 15 mm

Roll Dimensions:

Width x Length:

2.00 m x 50 m

Diameter:

47 - 52 cm

Weight:

90 kg

The following proofs must be submitted with the tender:

- Factory production control of the product

Optimal fixing:

The **Secumat® Green Coco N 900 10x15** should be secured to the ground with a wooden pin entitled **Secumat® Green PinW 30**.

Proof of Delivery (POD)

Secumat® Green Coco N 900 10x15

Naue GmbH & Co. KG

Gewerbestraße 2

32339 Espelkamp

GERMANY

Tel.: +49 57 43 41-0

Fax: +49 57 43 41-240

E-Mail: info@naue.com

www.naue.com

Status: 07.12.2021

Secumat® Green PinW

 Naue

The biodegradable erosion control fixing



naue.com

Building on sustainable ground.

Secumat® Green PinW fixings are the perfect addition to flat Secumat® Green erosion control solutions. They allow erosion control products installed on flat surfaces to be fixed to the subsoil with minimum space requirements.

Secumat® Green PinW 30 is a 30 cm long wooden pin with a integral cross bar. It is made using a fine-tooth saw and the knot-free, high-strength hard wood and is left untreated.

Typical Secumat® Green PinW applications

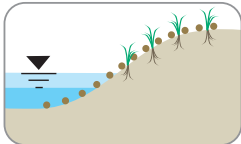


Figure 1:
Fixing vegetation
by water

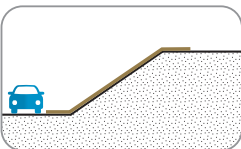


Figure 2:
Securing construction
projects with fixings

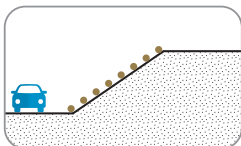


Figure 3:
Fixing the
infrastructure

1. Securing trench/brook slopes

When combined with Secumat® Green natural fibre products, Secumat® Green PinW provides fixing in the water transition zone. The wooden pins provide temporary fixing for natural fibre products on slopes. They fix the system in place and therefore enable initial vegetation, particularly in flowing or still water bodies. The established planting protects and secures the embankment against erosion. Secumat® Green PinW thus creates areas of biological diversity in urban environments. These biodegradable fixings are sustainable and help improve the climate. (Fig. 1)

2. Erosion control fixing technical construction projects

Secumat® Green PinW is an excellent solution, particularly when combined with temporary erosion control products such as our Secumat® Green natural fibre products. The wooden pins are frequently used to secure construction projects against erosion due to precipitation. The Secumat® Green Coco M coir mat is perfectly fixed with the wooden pin and provides contact between the erosion control mat and the subsoil to encourage roots to grow without disturbance. (Fig. 2)

3. Infrastructure slopes

Coir nets quickly establish a natural appearance on slopes on infrastructure construction projects. When combined with Secumat® Green PinW, an optimum connection between an erosion control product such as Secumat® Green Coco N and the substructure is ensured. The fixings secure the erosion control product to the ground and protect it from meteorological influences such as strong winds. (Fig. 3)

Benefits of using Secumat® Green PinW fixings

Particularly easy and quick insertion into the ground due to pointed end. Low installation costs due to quick and easy removal. Simple to use for efficient and cost-effective fixing. The integral cross bar fixes the areal product to the surface of the soil. The fixings take immediate effect after installation and thus form a complete erosion control system.



Figure 4: Coir net to be fixed with a wooden pin



Figure 5: Secumat® Green PinW 30 with
Secumat® Green Jute N 500 20x30



Figure 6: Secumat® Green PinW 30



Figure 7: Secumat® Green PinW packaging

Benefits of Secumat® Green PinW 30

- When combined with Secumat® Green natural fibre products, Secumat® Green PinW 30 fixings provide a high-quality and secure erosion control system from a single source.
- Secumat® Green PinW 30 is a robust fixing which, thanks to the sharpened end, can be easily and quickly inserted into the subsoil. The cross bar at the top fixes the flat product to the ground.
- Secumat® Green PinW 30 is particularly sustainable because the homogeneous, dense wood used is obtained from responsible sources and consists of regrowing raw materials.

Secumat® Green PinW 30 packaging

Secumat® Green PinW fixings are supplied packaged as follows:

Product	Property	Value
Secumat® Green PinW 30	Dimension (W x L x H)	32.5 x 32.5 x 28 cm
	Weight	8.25 kg/box
	Quantity	250 pieces/box



Secumat® is a registered trademark of Naue GmbH & Co. KG in various countries.

The information contained herein is, to the best of our knowledge, true and accurate. There is no implied or expressed warranty.

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naue.com

Secumat® 3D Meshes

Naue

The modular, permanent erosion control geomats



naue.com

Building on sustainable ground.

Secumat® 401 G4 and **Secumat® 601 G4** are extruded, three-dimensional erosion control mats consisting of a UV-stabilised, biologically and chemically resistant 3D mesh. Compared to Secumat® 601 G4, Secumat® 401 G4 has thinner more finely distributed filaments which makes it particularly suitable for use with fine-grained soils. Secumat 601 G4's thicker filaments make it an ideal solution for gravelly soils. The artificial root structure provides excellent erosion control due to soil and root stabilisation.

Secumat® 401 G4 and Secumat® 601 G4 erosion control products can reduce consequential costs and provide permanent protection for soil and plant structures when filled in with soil. A rashel fabric is also laminated onto one side of these 3D meshes as a support structure.

Typical application examples for Secumat® 3D Mesh products with Rashel fabric

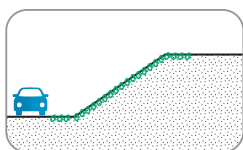


Figure 1:
Secumat® as a
green infrastructure

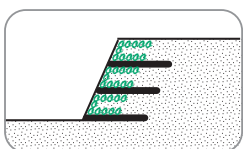


Figure 2:
Secumat® as
trickle protection in
facing systems

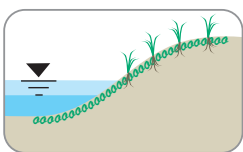


Figure 3:
Secumat®
as soil retention

1. Protect slopes in infrastructure projects such as road, highway and bridge construction

Secumat® 401 G4 offers particularly good soil retention for infrastructure projects with fine-grained, greenable soil. The coarser, more open structure of the Secumat® 601 G4 allows gravel fractions to settle perfectly and the robust three-dimensional structure provides good stabilisation for the granular content. In both instances, the monofilaments reduce the impact force of precipitation, create the basic framework for an open soil structure, and reduce surface run-off. (Fig. 1)

2. Vegetating, protecting and securing facing systems

Secumat® 401 G4 and Secumat® 601 G4 can be used in facing systems. The Secumat® 3D Mesh products in the front provide trickle protection and facilitate vegetation for quick integration of the facing surface into the landscape. This is the case when, for example, facing systems with an angle of up to 90° or a stepped structure need to be permanently secured against soil erosion in order to ensure secure footing during phases of low vegetative growth or when greening fails. (Fig. 2)

3. Vegetating trench/brook banks for rapid, long-term integration into the landscape

When used on trench/brook banks, the stronger and thicker Secumat® 601 G4 filament provides particularly good fixing for coarser soils. Permanent root stabilisation on natural banks with Secumat® 3D Mesh products can be reliably guaranteed, particularly in trenches and brooks with low flow velocities. (Fig. 3)

Benefits of using Secumat® 401 G4 and Secumat® 601 G4

Particularly quick and cost-effective installation due to easy handling and a low dead weight. No special tools or specific technical expertise are required to install. The 3D Mesh products with rashel fabric are installed as standard with an overlap. Alternatively, they can be fixed on slopes butted up to each without any cutting losses.

The system's integral support structure ensures quick installation and permanent, reliable functionality.



2 Figure 4: Secumat® PinU 23 steel pin



Figure 5: Secumat® 601 G4



Figure 6: Secumat® 401 G4 with initial vegetation

Secumat® 401 20/20 Q1 and **Secumat® 601 40/40 Q6** are extruded, three-dimensional erosion control mats consisting of a UV-stabilised, biologically and chemically resistant 3D Mesh. A geogrid is integrated into the underside of the 3D Mesh as a reinforcement structure at the factory. The artificial root structure provides excellent erosion control due to soil and root stabilisation and is suitable for preventing clods of soil breaking away near the surface of larger areas. Secumat® 3D Mesh products are to be covered with soil after installation and provide an immediate, permanent effect.

Secumat® 401 20/ 20 Q1 and Secumat® 601 40/ 40 Q6 erosion control products can reduce consequential costs, reinforcing and providing permanent protection for soil and plant structures.

Typical application examples for Secumat® 3D Mesh products with Geogrid

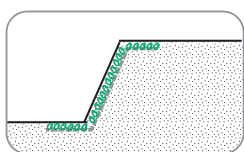


Figure 7:
Secumat® as a
green infrastructure

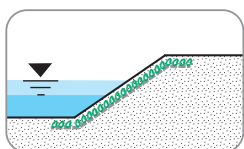


Figure 8:
3D mesh under water

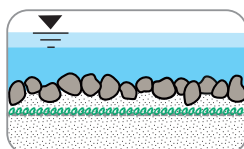


Figure 9:
Secumat® as
permanent protection

1. Protect slopes in infrastructure projects such as road, highway and bridge construction

Secumat® 401 20/20 Q1 offers particularly good soil retention for infrastructure projects with fine-grained, greenable soil. The coarser, more open structure of the Secumat® 601 40/40 Q6 allows gravel fractions to settle perfectly and the robust three-dimensional structure provides perfect stabilisation for the granular content. In both instances, the monofilaments create the basic framework for an open soil structure and reduce surface run-off. When used with the correct fixing, the geogrid components reduce the risk of clods of soil near the surface breaking away in specific areas. (Fig. 7)

2. Vegetating, protecting and securing trench/brook slopes

Secumat® 401 20/20 Q1 and Secumat® 601 40/40 Q6 can be used on trench/brook slopes. The Secumat® 3D Mesh product combinations integrated into the slope act to reduce the shear stresses and to aid vegetation for rapid integration. The geogrids support the tensile forces and secure the trench/brook slopes. The artificial root structure of the 3D Mesh supports plants in phases of low vegetative growth. (Fig. 8)

3. Fixing the beds of bodies of water

When used on the beds of bodies of water, the stronger and thicker Secumat® 601 40/40 Q6 filament provides particularly good fixing for coarser soils. The geogrid has a long-term tensile strength which optimises the product combination for use in areas with a constant flow. This reduces erosion of the bed and the trench is secured against the effects of high peak discharges. (Fig. 9)

Benefits of using Secumat® 401 20/20 Q1 and Secumat® 601 40/40 Q6

Particularly quick and cost-effective installation due to easy handling and a low dead weight. No special tools or specific technical expertise are required to install. The 3D mesh products are installed as standard with an overlap. In trenches, they are installed in the direction of the flow like roofing tiles. Alternatively, they can be fixed on slopes butted up to each without any cutting losses or in the Naue m³ system.

This system combines a three-dimensional mesh structure, reinforcing elements and a fixing system to provide reliable and permanent installation of a system for securing surfaces with an open pore structure which supports shear forces.

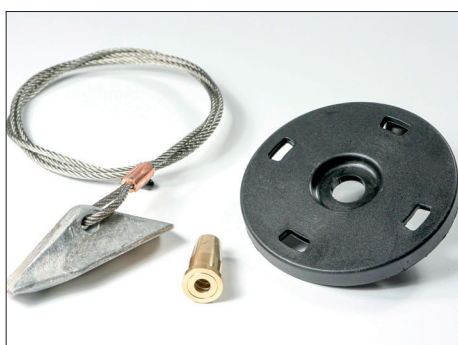


Figure 10: Secumat® Anchor 100 earth anchor

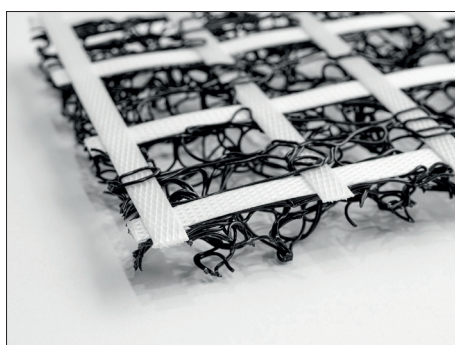


Figure 11: Secumat® 401 20/20 Q1



Figure 12: Secumat® 601 40/ 40 Q6
with initial vegetation

Secumat® 601 201 and **Secumat® 401 20/20 Q1 131 C** are extruded, three-dimensional erosion control mats consisting of a UV-stabilised, biologically and chemically resistant 3D Mesh. The 3D Mesh in Secumat® 401 20/20 Q1 131 C has an integral geogrid/nonwoven combination which acts as a reinforcing structure and filter structure. The 3D Mesh structure of Secumat® 601 201 is supplemented by an open-pore separating and nonwoven material. The artificial root structure provides excellent erosion control due to soil and root stabilisation. Secumat® 3D Mesh products are to be covered with soil after installation and are effective immediately.

Secumat® 601 201 and Secumat® 401 20/20 Q1 131 C erosion control products can reduce consequential costs, filter and providing permanent protection for soil and plant structures.

Typical application examples for Secumat® 3D Mesh products with Nonwoven

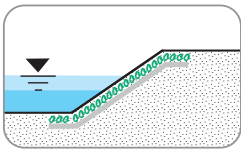


Figure 13:
Secumat® as a
green trench structure

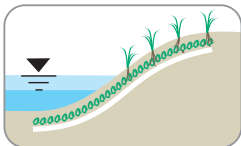


Figure 14:
Secumat® vegetating
streams

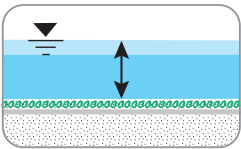


Figure 15:
Secumat®
under water

1. Protect slopes in hydraulic projects such as trench construction

Secumat® 401 20/20 Q1 131 C and Secumat® 601 201 are particularly advantageous for hydraulic projects where vegetation fails regularly and the introduced soil has to be separated from the subsoil in a filtered and stable manner. Typical applications are thin layers of gravel above fine-grained soils, subsoils susceptible to erosion, ungreened surfaces, etc. When combined with the reinforcing structure of the Secumat® 401 20/20 Q1 131 C and fixing systems, it is possible to stabilise loose clods close to the surface. (Fig. 13)

2. Vegetating, protecting and securing brook banks

Secumat® 601 201 and Secumat® 401 20/20 Q1 131 C can also be used on brook banks. They act as protection against flushing out and support for vegetation for rapid integration of the surface into the landscape. Fine particles are retained behind the nonwoven filter material on the slope which secures the infrastructure above it. Furthermore, the roots of plants can easily work their way into the 3D Mesh product combination as it acts as an artificial root network. (Fig. 14)

3. Fixing trench/brook beds

Sedimentary erosion on trench/brook beds can be prevented by using Secumat® 401 20/20 Q1 131 C. The permanent structure of the Secumat® 3D Mesh product combination can provide reliable and stable equilibrium on the bed, particularly where it is repeatedly attacked by running water. The integral geogrid structure supports the tensile forces and the nonwoven prevents the sediment from being flushed away. (Fig. 15)

Benefits of using Secumat® 601 201 and Secumat® 401 20/20 Q1 131 C

Particularly cost-effective installation due to easy handling and a low dead weight enables a particularly cost effective installation. No special tools or specific technical expertise are required to install. The 3D Mesh products are installed with an overlap or in the same way as roofing tiles in the direction of the flow, or fixed butted up to each without any cutting losses.

The combined system of the nonwoven filter material provides the system with many more options. The combination of three products can also support tensile forces near the surface.



4 Figure 16: Secumat® PinU 23 steel pin



Figure 17: Secumat® 601 201

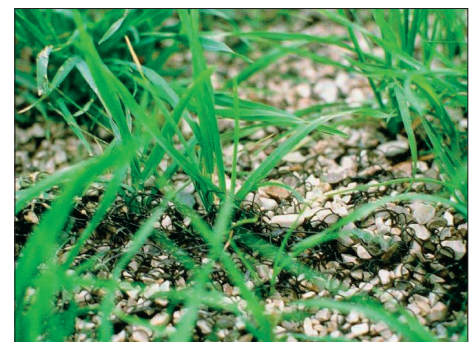


Figure 18: Secumat® 601 201
with initial vegetation



Figure 19: Storing e.g. Secumat® 601 G4



Figure 20: Secumat® 601 G4

Benefits of Secumat® 3D Mesh products

- Reliable and effective even under demanding conditions
- Can be used on slopes, in bodies of water, as part of the Naue m³ and as a trickle protection system
- Temperature-resistant, very high UV stability and chemically and biologically resistant
- For permanent erosion control even in phases of low vegetative growth or when vegetation fails due to stresses from drought conditions
- Extremely stable and yet flexible, permanently adapts to the flat surface through positive fit

Modular Secumat® 3D Mesh product variants

The following Secumat® 3D Mesh product types are available in standard rolls of 2m x 30m (width x length) - other sizes available on request:

Product	Total weight per unit area [g/m ²]	Roll weight [kg]
3D Mesh with Rashel fabric		
Secumat® 401 G4	430	26
Secumat® 601 G4	630	38
3D Mesh with Geogrid		
Secumat® 401 20/20 Q1	555	33
Secumat® 601 40/40 Q6	960	57.6
3D Mesh with Nonwoven		
Secumat® 601 201	800	48
Secumat® 401 20/20 Q1 131 C	685	41.1



Figure 21: Steep slope with 3D Mesh



Figure 22: Rail slope with 3D Mesh

Approvals for the Naue Group



SPECIFICATION TEXT PROPOSAL

Secumat® 401 G4

Pos.: Quantity: Unit Price: Total Price:

Geosynthetic erosion control mat, **Secumat® 401 G4** or equivalent, made by Naue GmbH & Co. KG, used as an erosion control system. Function supply and installation according to design, layout plans and manufacturer's installation guidelines.

Secumat® 401 G4 is a permanent, three-dimensional erosion control product for constant reduction of soil erosion due to erosive precipitation and surface overflow.

The two-part product consists of a UV-stabilized, extruded randomly oriented erosion control layer for soil and root stabilization. Here, the filament thickness and the mass per unit area form the artificial root zone in the layer thickness. Soil particles are embedded and plant roots can grow well in this.

Additionally, the product contains a stabilizing knitted fabric laminated to the bottom side for quick and easy installation.

Quantities are based on the area to be covered. Material for overlapping and cut-off must be included.

The following parameters must be considered for proof of equivalency:

Technical Data:

Complete product:

Raw material:	PP and PE
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Thickness (according to DIN EN ISO 9863-1):	20.0 mm
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Mass per unit area (according to DIN EN ISO 9864):	430 g/m ²
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Colour:	black
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Erosion control layer:

Raw material:	Polypropylene (PP)
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Filament thickness:	approx. 0.7 mm
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Mass per unit area (according to DIN EN ISO 9864):	400 g/m ²
---	----------------------

Carrier layer:

Raw material:	Polyethylene (PE)
Tensile strength (according to DIN EN ISO 10319):	$\geq 2.0 \text{ kN/m} / \geq 0.4 \text{ kN/m}$
Mass per unit area (according to DIN EN ISO 9864):	30 g/m^2

Roll Dimensions:

Width x Length:	2.00 m x 30 m
Diameter:	80 cm
Weight:	26 kg

The following proofs must be submitted with the tender:

- Factory production control of the product according to DIN 18200
- Certified quality management system according to DIN EN ISO 9001:2015
- Certified environmental management system according to DIN EN ISO 14001:2015
- Certified energy management system according to DIN EN ISO 50001:2011
- Proof of a product group EPD (Environmental Product Declaration)
- The product must be covered within two weeks after installation. However, an immediate covering may be required depending on project specific conditions.

Optimal fixing:

The **Secumat® 401 G4** should be permanently secured to the ground with isosceles U-shaped steel pins entitled **Secumat® PinU 23**.

Proof of Delivery (POD)**Secumat® 401 G4**

Naue GmbH & Co. KG
Gewerbestraße 2
32339 Espelkamp
GERMANY
Tel.: +49 57 43 41-0
Fax: +49 57 43 41-240
E-Mail: info@naue.com
www.naue.com

Status: 07.12.2021

SPECIFICATION TEXT PROPOSAL

Secumat® 601 G4

Pos.: Quantity: Unit Price: Total Price:

Geosynthetic erosion control mat, **Secumat® 601 G4** or equivalent, made by Naue GmbH & Co. KG, used as an erosion control system. Function supply and installation according to design, layout and manufacturer's installation guidelines.

Secumat® 601 G4 is a permanent, three-dimensional erosion control product for constant reduction of soil erosion due to erosive precipitation and surface overflow.

The two-part product consists of a UV-stabilized, extruded randomly oriented erosion control layer for soil and root stabilization. Here, the filament thickness and the mass per unit area form the artificial root zone in the layer thickness. Soil particles are embedded and plant roots can grow well in this.

Additionally, the product contains a stabilizing knitted fabric laminated to the bottom side for quick and easy installation.

Quantities are based on the area to be covered. Material for overlapping and cut-off must be included.

The following parameters must be considered for proof of equivalency:

Technical Data:

Complete product:

Raw material: PP and PE

Thickness
(according to DIN EN ISO 9863-1): 20.0 mm

Mass per unit area
(according to DIN EN ISO 9864): 630 g/m²

Colour: black

Erosion control layer:

Raw material: Polypropylene (PP)

Filament thickness: approx. 1.1 mm

Mass per unit area
(according to DIN EN ISO 9864): 600 g/m²

Carrier layer:

Raw material:	Polyethylene (PE)
Tensile strength (according to DIN EN ISO 10319):	$\geq 2.0 \text{ kN/m} / \geq 0.4 \text{ kN/m}$
Mass per unit area (according to DIN EN ISO 9864):	30 g/m^2

Roll Dimensions:

Width x Length:	2.00 m x 30 m
Diameter:	80 cm
Weight:	38 kg

The following proofs must be submitted with the tender:

- Factory production control of the product according to DIN 18200
- Certified quality management system according to DIN EN ISO 9001:2015
- Certified environmental management system according to DIN EN ISO 14001:2015
- Certified energy management system according to DIN EN ISO 50001:2011
- Proof of a product group EPD (Environmental Product Declaration)
- The product must be covered within two weeks after installation. However, an immediate covering may be required depending on project specific conditions.

Optimal fixing:

The **Secumat® 601 G4** should be permanently secured to the ground with isosceles U-shaped steel pins entitled **Secumat® PinU 23**.

Proof of Delivery (POD)**Secumat® 601 G4**

Naue GmbH & Co. KG
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GERMANY
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Fax: +49 57 43 41 240
E-Mail: info@naue.com
www.naue.com

Status: 07.12.2021

SPECIFICATION TEXT PROPOSAL

Secumat® 401 20/20 Q1

Pos.: Quantity: Unit Price: Total Price:

Combinated geosynthetic erosion control mat, **Secumat® 401 20/20 Q1** or equivalent, made by Naue GmbH & Co. KG, used as an erosion control system. Function supply and installation according to design, layout plans and manufacturer's installation guidelines.

Secumat® 401 20/20 Q1 is a permanent, three-dimensional erosion control product to protect the soil surface from erosive precipitation, to reduce soil redistribution and to absorb shear stresses above, below and in the water exchange zone.

The combined product consists of a UV-stabilised, extruded randomly oriented filament layer for soil and root stabilisation of the vegetation layer. Here, the filament thickness and the mass per unit area over the layer thickness form the artificial root zone. Soil particles are embedded and plant roots can grow well in this.

Additionally, the product gets its structural strength from a laid geogrid embedded on the bottom side made of stretched, textured, monolithic flat bars with welded nodes. The high tensile strength of the geogrid ensures the long-term stability of the vegetation layer, especially on steep slopes. It is used as soil reinforcement in earthworks, landfill construction, traffic route construction and hydraulic engineering. The product is easy to handle and enables quick and secure installation.

Quantities are based on the area to be covered. Material for overlapping and cut-off must be included.

The following parameters must be considered for proof of equivalency:

Technical Data:

Complete product:

Raw material:	Polypropylene (PP)
Thickness (According to DIN EN ISO 9863-1):	20.0 mm
Mass per unit area (according to DIN EN ISO 9864):	555 g/m ²
Colour:	black and white

Erosion control layer:

Raw material:	Polypropylene (PP)
Filament thickness:	approx. 0.7 mm
Mass per unit area (according to DIN EN ISO 9864):	400 g/m ²
Colour:	black

Geogrid:

Raw material	Polypropylene (PP)
Grid opening:	33 x 33 mm
UV resistance (according to EN 12224):	95 %
Nominal Tensile Strength (md/cmd) (according to DIN EN ISO 10319):	≥ 20 / ≥ 20 kN/m
Tensile Strength at 1% Elongation (md/cmd) (according to DIN EN ISO 10319):	4 / 4 kN/m
Tensile Strength at 2% Elongation (md/cmd) (according to DIN EN ISO 10319):	8 / 8 kN/m
Tensile Strength at 5% Elongation (md/cmd) (according to DIN EN ISO 10319):	16 / 16 kN/m
Elongation at Nominal Tensile Strength (md/cmd) (according to DIN EN ISO 10319):	≤ 7 / ≤ 7 %
Construction related strain:	0 %
Product Identification/Imprint:	max. 5.0 m distance
Mass per unit area (according to DIN EN ISO 9864):	155 g/m ²
Colour:	white

Rollenabmessungen:

Breite x Länge:	2,00 m x 30 m
Durchmesser:	80 cm
Gewicht:	33 kg

Folgende Nachweise müssen mit Angebotsabgabe vorliegen:

- Werkseigene Produktionskontrolle des Produktes nach DIN 18200
- Zertifiziertes Qualitätsmanagementsystem nach DIN EN ISO 9001:2015
- Zertifiziertes Umweltmanagementsystem nach DIN EN ISO 14001:2015
- Zertifiziertes Energiemanagementsystem nach DIN EN ISO 50001:2011
- Aktuelle CE-Kennzeichnung
- Leistungserklärung/DoP gemäß Bauprodukteverordnung des Europäischen Parlaments und des Europäischen Rates nach DIN EN ISO 13249ff:2016
- Nachweis einer Produktgruppen-EPD (Umweltproduktdeklaration)
- Beständigkeit (gemäß Annex B der entsprechenden europäischen Anwendungsnorm) für mindestens 100 Jahre beim Einsatz ohne Bewehrungsfunktion in natürlichen Böden mit einem pH-Wert zwischen 4 und 9 und einer Bodentemperatur von < 25 °C auf Grundlage der Ergebnisse des Prüfverfahrens und Prüfdauer nach B.4.2.2.
- Das Produkt ist innerhalb von zwei Wochen nach der Verlegung zu bedecken. Projektspezifisch kann jedoch eine sofortige Bedeckung erforderlich sein.

Favorisierte Befestigung:

Die **Secumat® 401 20/20 Q1** sollte dauerhaft mit Erdankern des Typs **Secumat® Anchor 100** oder **Secumat® Anchor 150** befestigt werden.

Liefernachweis

Secumat® 401 20/20 Q1

Naue GmbH & Co. KG
Gewerbestraße 2
32339 Espelkamp
Tel.: 05743 41-0
Fax: 05743 41-240
E-Mail: info@naue.com
www.naue.com

Stand: 07.12.2021

SPECIFICATION TEXT PROPOSAL

Secumat® 601 40/40 Q6

Pos.: Quantity: Unit Price: Total Price:

Combinated geosynthetic erosion control mat, **Secumat® 601 40/40 Q6** or equivalent, made by Naue GmbH & Co. KG, used as an erosion control system. Function supply and installation according to design, layout plans and manufacturer's installation guidelines.

Secumat® 601 40/40 Q6 is a permanent, three-dimensional erosion control product to protect the soil surface from erosive precipitation, to reduce soil redistribution and to absorb shear stresses above, below and in the water exchange zone.

The combined product consists of a UV-stabilised, extruded randomly oriented filament layer for soil and root stabilisation of the vegetation layer. Here, the filament thickness and the mass per unit area over the layer thickness form the artificial root zone. Soil particles are embedded and plant roots can grow well in this.

Additionally, the product gets its structural strength from a laid geogrid embedded on the bottom side made of stretched, textured, monolithic flat bars with welded nodes. The high long-term tensile strength of the geogrid ensures the long-term stability of the vegetation layer, especially on steep slopes. It is used as soil reinforcement in earthworks, landfill construction, traffic route construction and hydraulic engineering. The product is easy to handle and enables quick and secure installation.

Quantities are based on the area to be covered. Material for overlapping and cut-off must be included.

The following parameters must be considered for proof of equivalency:

Technical Data:

Complete product:

Raw material:	PP and PET
Thickness (according to DIN EN ISO 9863-1):	20.0 mm
Mass per unit area (according to DIN EN ISO 9864):	960 g/m ²
Colour:	black and transparent

Erosion control layer:

Raw material:	Polypropylene (PP)
Filament thickness:	approx. 1.1 mm
Mass per unit area (according to DIN EN ISO 9864):	600 g/m ²
Colour:	black

Geogrid:

Raw material	Polyester (PET)
Grid opening:	34 mm x 34 mm
Nominal Tensile Strength (md/cmd) (according to DIN EN ISO 10319):	≥ 40 kN/m / ≥ 40 kN/m
Tensile Strength at 2% Elongation (md/cmd) (according to DIN EN ISO 10319):	18 kN/m / 18 kN/m
Elongation at Nominal Tensile Strength (md/cmd) (according to DIN EN ISO 10319):	≤ 7 % / ≤ 7 %
Product Identification/Imprint:	max. 5.0 m distance
Tensile modulus at 1% strain; J _{0%-1%} , k ₀ (md/cmd), according to EBGeo:	1,000 kN/m / 1,000 kN/m
Radial Stiffness at 0.5% strain (according to DIN EN ISO 10319):	≥ 450 kN/m
Cyclic Tensile Modulus at 0,5% strain; J _{0,5%} (md) (according to ASTM D7556, Method A):	1.600 kN/m
Torsional Rigidity (according to GRI GG9):	≥ 1,700 N-mm/deg.
Max. creep strain at 30 % degree of utilization (EN ISO 13431) (To be determined by Isochronous Curves for a period between 1 hour – 120 years):	≤ 0.50 %

Konstruktionsdehnung:	0 %
Masse pro Flächeneinheit: (nach DIN EN ISO 9864)	360 g/m ²
Farbe:	transparent

Rollenabmessungen:

Breite x Länge:	2,00 m x 30 m
Durchmesser:	80 cm
Gewicht:	56,7 kg

Folgende Nachweise müssen mit Angebotsabgabe vorliegen:

- Werkseigene Produktionskontrolle des Produktes nach DIN 18200
- Zertifiziertes Qualitätsmanagementsystem nach DIN EN ISO 9001:2015
- Zertifiziertes Umweltmanagementsystem nach DIN EN ISO 14001:2015
- Zertifiziertes Energiemanagementsystem nach DIN EN ISO 50001:2011
- Aktuelle CE-Kennzeichnung
- Leistungserklärung/DoP gemäß Bauprodukteverordnung des Europäischen Parlaments und des Europäischen Rates nach DIN EN ISO 13249ff:2016
- Nachweis einer Produktgruppen-EPD (Umweltproduktdeklaration)
- Beständigkeit (gemäß Annex B der entsprechenden europäischen Anwendungsnorm) für mindestens 100 Jahre beim Einsatz ohne Bewehrungsfunktion in natürlichen Böden mit einem pH-Wert zwischen 4 und 9 und einer Bodentemperatur von < 25 °C auf Grundlage der Ergebnisse des Prüfverfahrens und Prüfdauer nach B.4.2.2.
- Das Produkt ist innerhalb von zwei Wochen nach der Verlegung zu bedecken. Projektspezifisch kann jedoch eine sofortige Bedeckung erforderlich sein.

Favorisierte Befestigung:

Die **Secumat® 601 40/40 Q6** sollte dauerhaft mit Erdankern des Typs **Secumat® Anchor 100** oder **Secumat® Anchor 150** befestigt werden.

Liefernachweis

Secumat® 601 40/40 Q6

Naue GmbH & Co. KG
 Gewerbestraße 2
 32339 Espelkamp
 Tel.: 05743 41-0
 Fax: 05743 41-240
 E-Mail: info@naue.com
www.naue.com

Stand: 07.12.2021

SPECIFICATION TEXT PROPOSAL

Secumat® 601 201

Pos.: Quantity: Unit Price: Total Price:

Combinated geosynthetic erosion control mat, **Secumat® 601 201** or equivalent, made by Naue GmbH & Co. KG, used as an erosion control system. Function supply and installation according to design, layout plan and manufacturer's installation guidelines.

Secumat® 601 201 is a permanent, three-dimensional erosion control product for constant reduction of soil erosion due to erosive precipitation and surface overflow.

The two-part product consists of a UV-stabilised, extruded randomly oriented erosion control layer for root stabilization. Here, the filament thickness and the mass per unit area form the artificial root zone in the layer thickness. Soil particles are embedded and plant roots can grow well in this.

Additionally, the product contains an open pored fiber reinforcing separation and filtration structure of a single-layer, mechanically bonded nonwoven fabric laminated to the bottom side as a washout protection. The product is easy to handle and enables quick and simple installation.

Quantities are based on the area to be covered. Material for overlapping and cut-off must be included.

The following parameters must be considered for proof of equivalency:

Technical Data:

Complete product:

Raw material:	PP
Thickness (according to DIN EN ISO 9863-1):	20.0 mm
Mass per unit area (according to DIN EN ISO 9864):	800 g/m ²
Colour:	black and white

Erosion control layer:

Raw material:	Polypropylene (PP)
Filament thickness:	approx. 1.1 mm

Thickness (according to DIN EN ISO 9863-1):	20.0 mm
Mass per unit area (according to DIN EN ISO 9864):	600 g/m ²
Colour:	black

Nonwoven:

Raw material:	Polypropylene (PP)
Characteristic opening size (according to DIN EN ISO 12956):	120 µm
Thickness:	2.5 mm
Water permeability V _{H50} -Index (according to DIN EN ISO 11058):	100 l/(m ² s)
Mass per unit area (according to DIN EN ISO 9864):	200 g/m ²
Static puncture (according to DIN EN ISO 12236):	1.800 N
Displacement at static puncture strength (according to DIN EN ISO 12236):	30 mm
Detector tested:	yes
Product marking/imprinting:	max. 5.0 m distance
Colour:	white

Roll Dimensions:

Width x Length:	2.00 m x 25 m
Diameter:	80 cm
Weight:	48 kg

The following proofs must be submitted with the tender:

- Factory production control of the product according to DIN 18200
- Certified quality management system according to DIN EN ISO 9001:2015
- Certified environmental management system according to DIN EN ISO 14001:2015
- Certified energy management system according to DIN EN ISO 50001:2011
- Proof of a product group EPD (Environmental Product Declaration)
- The product must be covered within two weeks after installation. However, immediate covering may be required depending on project specific conditions.

Optimal fixing:

The **Secumat® 601 201** should be permanently secured to the ground with isosceles U-shaped steel pins entitled **Secumat® PinU 23**.

Proof of Delivery (POD)

Secumat® 601 201

Naue GmbH & Co. KG

Gewerbestraße 2

32339 Espelkamp

GERMANY

Tel.: +49 57 43 41 0

Fax: +49 57 43 41 240

E-Mail: info@naue.com

www.naue.com

Status: 07.12.2021

SPECIFICATION TEXT PROPOSAL

Secumat® 401 20/20 Q1 131 C

Pos.: Quantity: Unit Price: Total Price:

Combinated geosynthetic erosion control mat, **Secumat® 401 20/20 Q1 131 C** or equivalent, made by Naue GmbH & Co. KG, used as an erosion control system. Function supply and installation according to design, layout plans and manufacturer's installation guidelines.

Secumat® 401 20/20 Q1 131 C is a permanent, three-dimensional erosion control product to protect the soil surface from erosive precipitation, to reduce soil redistribution and to absorb shear stresses above, below and in the water exchange zone.

The combined product consists of a UV-stabilised, extruded randomly oriented filament layer for root stabilization of the vegetation layer. Here, the filament thickness and the mass per unit area over the layer thickness form the artificial root zone. Soil particles are embedded and plant roots can grow well in this.

Secondly, the product gets its structural strength from a laid geogrid embedded on one side made of stretched, textured, monolithic flat bars with welded nodes. The high tensile strength of the geogrid ensures the long-term stability of the vegetation layer, especially on steep slopes. It is used as soil reinforcement in earthworks, landfill construction, traffic route construction and hydraulic engineering.

Thirdly, the combined product contains a separation and filtration single-layer, mechanically bonded nonwoven fabric laminated on the bottom side as a washout protection. The product is easy to handle and enables quick and secure installation.

Quantities are based on the area to be covered. Material for overlapping and cut-off must be included.

The following parameters must be considered for proof of equivalency:

Technical Data:

Complete product:

Raw material:	Polypropylene (PP)
Thickness (according to DIN EN ISO 9863-1):	20.0 mm
Mass per unit area (according to DIN EN ISO 9864):	685 g/m ²
Colour:	black and white

Erosion control layer:

Raw material:	Polypropylene (PP)
Filament thickness:	approx. 0.7 mm
Thickness (according to DIN EN ISO 9863-1):	20.0 mm
Mass per unit area (according to DIN EN ISO 9864):	400 g/m ²
Colour:	black

Geogrid:

Raw material	Polypropylene (PP)
Grid opening:	33 mm x 33 mm
UV resistance (according to EN 12224):	95 %
Nominal Tensile Strength (md) (according to DIN EN ISO 10319):	≥ 20 kN/m
Elongation at Nominal Tensile Strength (md) (according to DIN EN ISO 10319):	≤ 7 %
Construction related strain:	0 %
Product Identification/Imprint:	max. 5.0 m distance
Mass per unit area (according to DIN EN ISO 9864):	155 g/m ²
Colour:	white

Nonwoven:

Raw material:	Polypropylene (PP)
Thickness:	ca. 0.7 mm
Mass per unit area (according to DIN EN ISO 9864):	130 g/m ²
Detector tested:	yes
Product marking/imprinting:	max. 5.0 m distance
Colour:	white

Roll Dimensions:

Width x Length:	2.00 m x 30 m
Diameter:	80 cm
Weight:	41,1 kg

The following proofs must be submitted with the tender:

- Factory production control of the product according to DIN 18200
- Certified quality management system according to DIN EN ISO 9001:2015
- Certified environmental management system according to DIN EN ISO 14001:2015
- Certified energy management system according to DIN EN ISO 50001:2011
- Current CE-marking
- Declaration of performance/DoP according to the Construction Products Regulation of the European Parliament and of the European Council according to DIN EN ISO 13249ff:2016
- Proof of a product group EPD (Environmental Product Declaration)
- Resistance (according to Annex B of the relevant European Application Standard) for at least 100 years when used without a reinforcement function in natural soils with a pH value between 4 and 9 and a soil temperature of < 25 °C based on the results of the test procedure and test duration according to B.4.2.2.
- The product must be covered within two weeks after installation. However, an immediate covering may be required depending on project specific conditions.

Optimal fixing:

The **Secumat® 401 20/20 Q1 131 C** should be permanently secured to the ground with earth anchors entitled **Secumat® Anchor 100** or **Secumat® Anchor 150**.

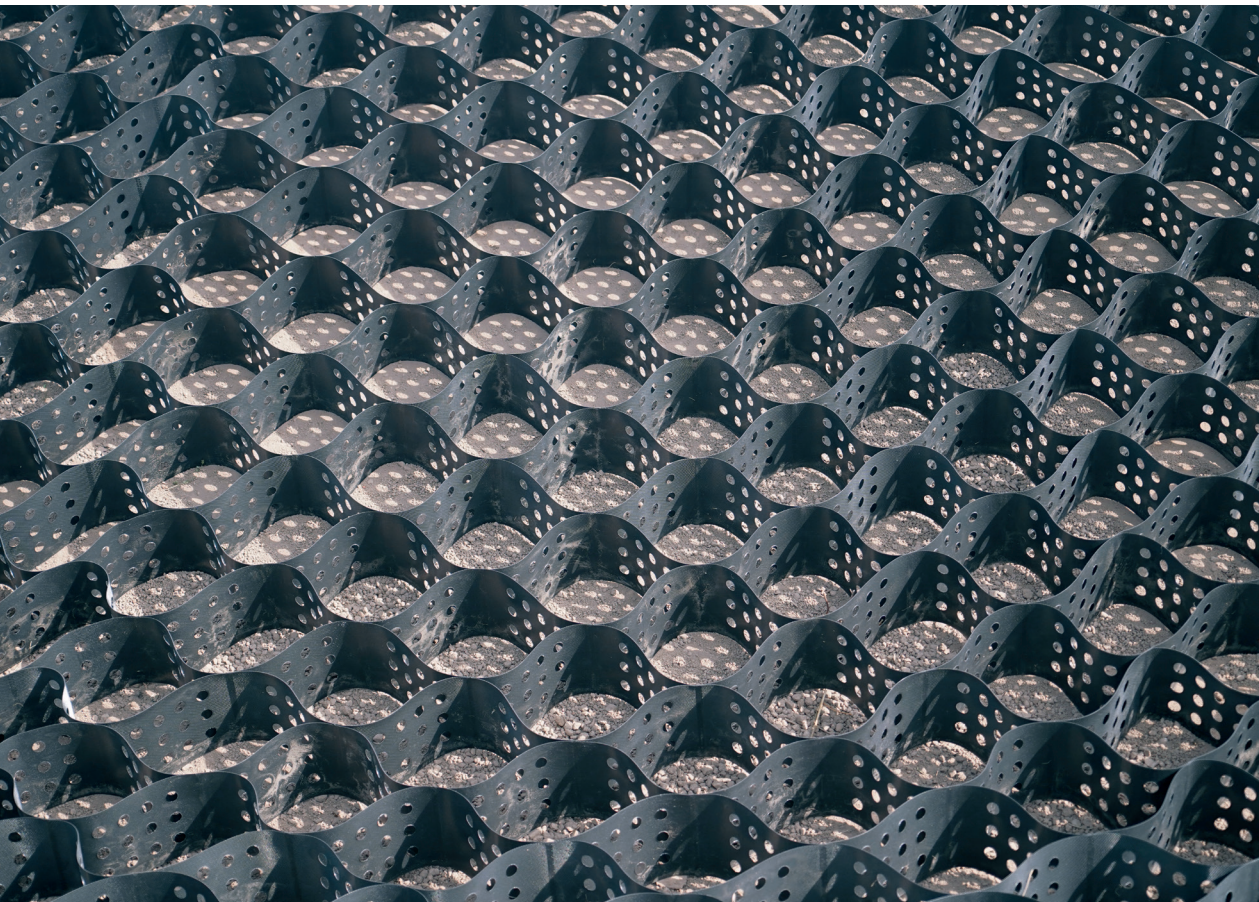
Proof of Delivery (POD)
Secumat® 401 20/20 Q1 131 C
Naue GmbH & Co. KG
Gewerbestraße 2
32339 Espelkamp
GERMANY
Tel.: +49 57 43 41 - 0
Fax: +49 57 43 41 - 240
E-Mail: info@naue.com
www.naue.com

Status: 07.12.2021

Secumat® Cell



The versatile, permanent erosion control geocells



naue.com

Building on sustainable ground.

Secumat® Cell geocells are high-quality, areal processed products comprising pocket-like cells which have high UV stability and are chemically and biologically resistant. Secumat® Cell geocells have a special surface texture which ensures optimum contact between the geocells and the filling material. The cell walls are perforated in order to provide a hydraulic connection between the individual pockets and to allow excess water to drain away. The perforation therefore also provides a path for roots to grow between cells.

A wide variety of filling materials can be used with Secumat® Cell. They are held in place by the pocket-like structure and thus provide erosion control.

Typical Secumat® Cell applications

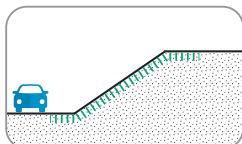


Figure 1:
Secumat® as a
green infrastructure

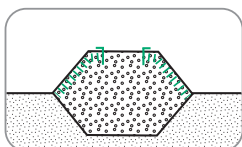


Figure 2:
Secumat® as
membrane protection

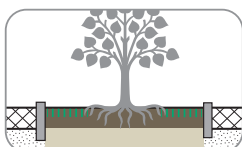


Figure 3:
Secumat® as
growth propagator

1. Protect slopes in infrastructure projects such as road, highway and bridge construction

Secumat® Cell can be used in many different infrastructure projects. A particular benefit is that different filling materials can be used. These may already be present on site or can be acquired inexpensively. The filling material can therefore be selected to suit the surface properties without having to be optimised to steep slopes. The cell structure is suitable for use with a very broad range of filling materials such as topsoil, sand, crushed stone, etc. (Fig. 1).

2. Vegetating, protecting and securing seals such as geomembrane or clay liners, e.g. slopes on landfill sites

Secumat® Cell can be statically secured and installed close to the surface on steep slopes or above sealing systems such as surface sealing systems on landfill sites. (Fig. 2)

3. Vegetating for rapid, long-term integration into the landscape

Planting can also be quickly established by using Secumat® Cell geocells in areas where vegetation would not have been possible without technical support or in demanding climatic or soil conditions (Fig. 3)

Benefits of using Secumat® Cell

Easy handling and minimal product bulk ensures economical transportation, lower environmental impact by reducing CO₂ emissions, and quick, cost-effective installation. No special tools or specific technical expertise are required to install. Sections are easily connected using the Secumat® Screw system. The sections are fixed to the ground using construction steels provided on site combined with the Secumat® PinCap system.

This provides high system security and tensile strength thanks to the large connecting surface area on the cell walls for the screws.

Rain water can pass through the cells due to their design, thus avoiding waterlogging. This encourages plant growth within the pockets which in turn binds the soil to the Secumat® Cell. This guarantees vegetated and sustainable soil retention with rapid integration into the landscape.



2 Figure 4: Secumat® Screw system
of screw and nut



Figure 5: Secumat® PinCap as an end cap



Figure 6: Secumat® Cell 150 geocell high screwed
together with Secumat® Screw and fixed to the
soil with Secumat® PinCap



Figure 7: Secumat® Cell 100

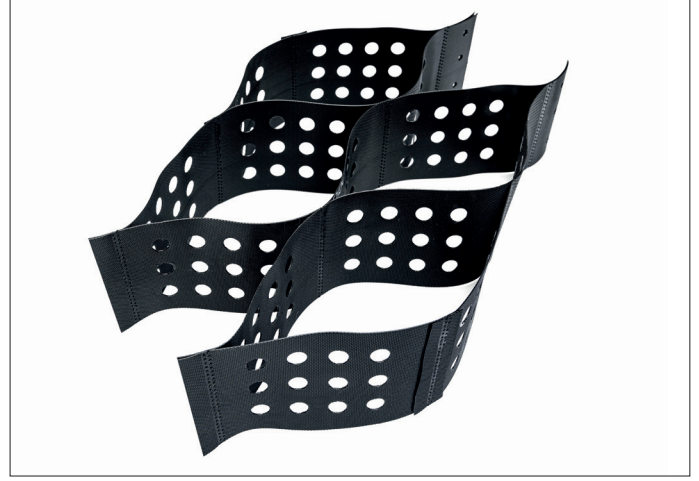


Figure 8: Secumat® Cell 150

Benefits of Secumat® Cell

- Reliable and effective even under demanding conditions
- Can be used on slope inclinations up to 50°: The best solution where a product secures steep slope, such as on landfill sites or existing slopes
- Temperature resistant, high UV stability, chemically and biologically resistant
- Extremely stable yet flexible (stress cracking resistance tested to ASTM – D1693)

Versatile Secumat® Cell variants

Secumat® Cell is available in the following variants (others available on request):

Product	Property	Value [cm]
Secumat® Cell 100	Cell pocket dimensions (W x L x H)	24.4 x 20.5 x 10
	Section dimensions (W x L x H)	257 x 779 x 10
Secumat® Cell 150	Cell pocket dimensions (W x L x H)	34.2 x 28.7 x 15
	Section dimensions (W x L x H)	318 x 1090 x 15

The connecting system for the geocell sections, Secumat® Screw, is included with the delivery and is calculated and packed for each project. Secumat® PinCap closing caps for fixing to the construction steel are also available for purchase. (Fig. 4 & 5)



Figure 9: Laying out Secumat® Cell 150 on a slope



Figure 10: Inserting Secumat® PinCap

Approvals for the Naue Group



Secumat® is a registered trademark of Naue GmbH & Co. KG in various countries.

The information contained herein is, to the best of our knowledge, true and accurate. There is no implied or expressed warranty.

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naue.com

SPECIFICATION TEXT PROPOSAL

Secumat® Cell 100

Pos.: Quantity: Unit Price: Total Price:

Geosynthetic erosion control cell, **Secumat® Cell 100** or equivalent, made by Naue GmbH & Co. KG, used as an erosion control system. Function supply and installation according to design, layout plans and manufacturer's installation guidelines.

Secumat® Cell 100 is a three-dimensional erosion control product for permanent reduction against the consequences of erosive precipitation in round-grained or coarser soils.

The product consists of chemically and biologically resistant solid cell walls welded together for soil and root stabilisation. The cell walls have perforations so that there is a hydraulic coupling of the cells. To improve the contact with the soil, the surface of the cells is textured. Soil particles and plant roots can embed well in these cells.

The product can be used over a wide surface for erosion control. It stabilises the soil surface in earthworks, landfill construction, traffic route construction and hydraulic engineering.

The geocell is permanently connected section by section with the **Secumat® Screw** connecting element (screw plus nut), which is included in the scope of delivery. Quantities are based on the area to be covered. Material for cut-off must be included in the calculation.

The following parameters must be considered for proof of equivalency:

Technical Data:

Raw material:	Polyethylene (PE)
Thickness of cell wall: (according to ASTM D 5199)	1.4 mm
Cell area:	250.1 cm ²
Cell dimensions:	24.4 cm / 20.5 cm / 10 cm
Number of perforations per cell:	4 times 6 perforations
Perforation diameter:	20 mm
Texture depth:	0.3 mm

Colour:	black
Tensile strength: (according to EN ISO 13426-1)	22.5 kN/m
Shear strength: (according to EN ISO 13426-1)	12.7 kN/m
Split strength: (according to EN ISO 13426-1)	24.2 kN/m
Connection strength: (according to ISO 101319)	19.4 kN/m

Section Dimensions:

Width x Length:	2.57 m x 7.79 m
Diameter:	10 cm
Weight:	13.2 kg

The following proofs must be submitted with the tender:

- Certified quality management system according to DIN EN ISO 9001:2015
- Certified environmental management system according to DIN EN ISO 14001:2015
- The product must be covered within two weeks after installation. However, an immediate covering may be required depending on project specific conditions.

Optimal fixing:

The **Secumat® Cell 100** should be permanently secured to the ground with an anchoring system in accordance with the project-specific requirements or the manufacturer's installation guidelines. For the fixation, concrete bar steel (to be provided by the customer; e.g. B550B; 18 mm ≥ diameter ≥ 10 mm; length = 3 x cell height, unless otherwise defined for the project) and **Secumat® PinCap** end caps are to be used and installed according to the installation guidelines.

SPECIFICATION TEXT PROPOSAL

Secumat® Cell 150

Pos.: Quantity: Unit Price: Total Price:

Geosynthetic erosion control cell, **Secumat® Cell 150** or equivalent, made by Naue GmbH & Co. KG, used as an erosion control system. Function supply and installation according to design, layout plans and manufacturer's installation guidelines.

Secumat® Cell 150 is a three-dimensional erosion control product for permanent reduction against the consequences of erosive precipitation in round-grained or coarser soils.

The product consists of chemically and biologically resistant solid cell walls welded together for soil and root stabilisation. The cell walls have perforations so that there is a hydraulic coupling of the cells. To improve the contact to the soil, the surface of the cells is textured. Soil particles and plant roots can embed well in these cells.

The product can be used over a wide surface for erosion control. It is used to stabilise the soil surface in earthworks, landfill construction, traffic route construction and hydraulic engineering.

The geocell is permanently connected section by section with the **Secumat® Screw** connecting element (screw plus nut), which is included in the scope of delivery. Quantities are based on the area to be covered. Material for cut-off must be included in the calculation.

The following parameters must be considered for proof of equivalency:

Technical Data:

Raw material:	Polyethylene (PE)
Thickness of cell wall: (according to ASTM D 5199)	1.4 mm
Cell area:	491 cm ²
Cell dimensions:	34.2 cm / 28.7 cm / 15 cm
Number of perforations per cell:	4 times 12 perforations
Perforation diameter:	20 mm
Texture depth:	0.3 mm

Colour:	black
Tensile strength: (according to EN ISO 13426-1)	22.5 kN/m
Shear strength: (according to EN ISO 13426-1)	12.7 kN/m
Split strength: (according to EN ISO 13426-1)	24.2 kN/m
Connection strength: (according to ISO 101319)	19.4 kN/m

Section Dimensions:

Width x Length:	3.18 m x 10.9 m
Diameter:	15 cm
Weight:	14.3 kg

The following proofs must be submitted with the tender:

- Certified quality management system according to DIN EN ISO 9001:2015
- Certified environmental management system according to DIN EN ISO 14001:2015
- The product must be covered within two weeks after installation. However, an immediate covering may be required depending on project specific conditions.

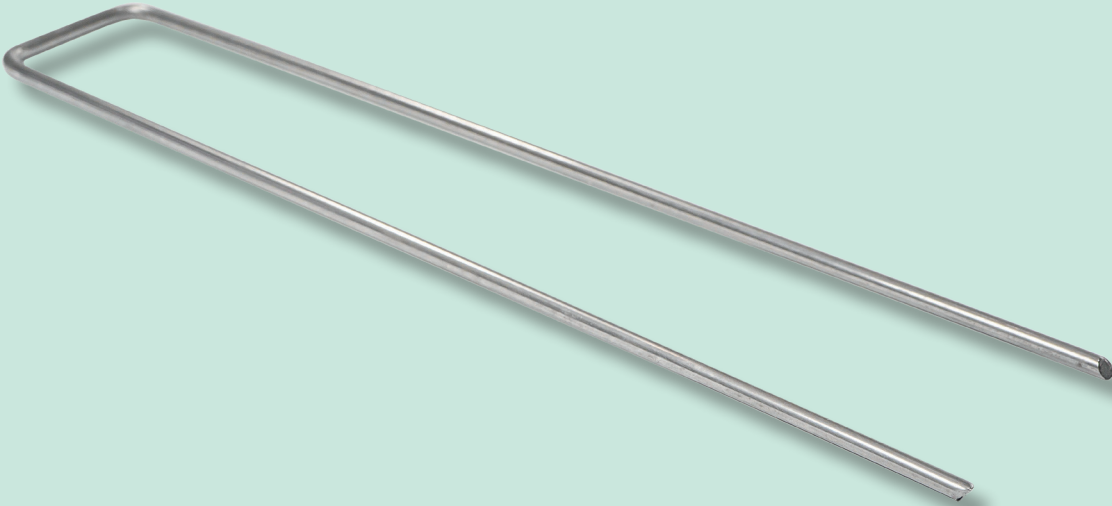
Optimal fixing:

The **Secumat® Cell 150** should be permanently secured to the ground with an anchoring system in accordance with the project-specific requirements or the manufacturer's installation guidelines. For the fixation, concrete bar steel (to be provided by the customer; e.g. B550B; 18 mm ≥ diameter ≥ 10 mm; length = 3 x cell height, unless otherwise defined for the project) and **Secumat® PinCap** end caps are to be used and installed according to the installation guidelines.

Secumat® PinU

 Naue

The permanent erosion control fixing



naue.com

Building on sustainable ground.

The **Secumat® PinU fixings** are the perfect addition to areal Secumat® 3D Mesh erosion control mat. They allow erosion control products installed on flat surfaces to be fixed to the subsoil with minimum space requirements.

Secumat® PinU 23 is a U-shaped steel pin which is sturdy but easy to use. The steel has a diameter of $\varnothing 3,5$ mm and a length of 23 cm.

Typical Secumat® PinU applications

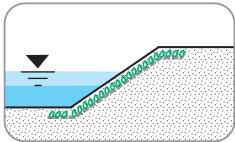


Figure 1:
Fixing vegetation
by water

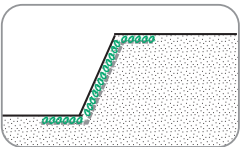


Figure 2:
Securing construction
projects with fixings

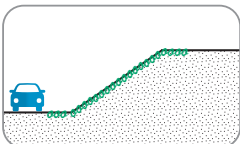


Figure 3:
Fixing the
infrastructure

1. Securing trench/brook banks

When combined with Secumat® 3D Mesh with Nonwoven, Secumat® PinU provides fixing in the water transition zone. Especially geosynthetic products can be permanently fixed on slopes using steel pins. They fix the system in place and therefore enable initial vegetation, particularly in flowing or still water bodies. The established vegetation secures the slope against erosion. Secumat® PinU thus creates areas of biological diversity in urban environments. Permanent fixing provides long-term control. (Fig. 1)

2. Erosion control securing technical construction projects

Using Secumat® PinU steel pins is highly recommended, particularly when combined with permanent erosion control solutions such as our Secumat® 3D Mesh and combination products. Secumat® PinU is frequently used to secure construction projects against rainfall erosion. The Secumat® 3D Mesh is perfectly fixed with the steel pin and provides minimal contact between the erosion control system and the subsoil to encourage roots to grow undisturbed. (Fig. 2)

3. Fixing infrastructure slopes

Secumat® 3D Mesh products quickly establish a natural appearance on slopes on infrastructure construction projects. When combined with Secumat® PinU, an optimum connection between an erosion control product such as Secumat® 3D Mesh products and the subsoil is ensured. The fixings secure the erosion control system to the ground and protect it from meteorological influences such as high winds. (Fig. 3)

Benefits of using Secumat® PinU fixings

Particularly easy and quick insertion into the ground due to the pointed ends. Low installation costs due to quick and easy removal. Simple to use for efficient and cost-effective fixing. There are no sharp edges left on the surface and the risk of injury due to tripping or snagging on areal products is reduced to a minimum. The fixings take effect immediately after installation and thus form a complete erosion control system.



Figure 4: Secumat® PinU 23 with Secumat® 401 20/20 Q1



Figure 5: Secumat® 3D Mesh fixed with a steel pin



Figure 6: Secumat® PinU 23



Figure 7: Secumat® PinU packaging

Benefits of Secumat® PinU 23

- When combined with Secumat® 3D Mesh products, Naue Secumat® PinU 23 fixings provide a high-quality and secure erosion control system from a single source.
- Secumat® PinU 23 is a sturdy fixing which offers an unbroken connection to the substructure thanks to its U-shape and secures products with an overlap as well as those installed butted up to each other.
- Easy to insert into the substructure due to the pointed ends.

Secumat® PinU 23 packaging

Secumat® PinU steel pins are supplied packaged as follows:

Product	Property	Value
Secumat® Pin U 23	Dimension (W x L x H)	25 x 20 x 10 cm
	Weight	9 kg/box
	Quantity	250 pieces/box



Secumat® Anchor

 Naue

The permanent earth anchor system



naue.com

Building on sustainable ground.

Secumat® Anchor 100 and **Secumat® Anchor 150** are earth anchor systems for fixing areal Secumat® products, specifically Secumat® product combinations of 3D Mesh and Geogrid.

They provide secure retention on challenging gradients. When combined with our areal erosion control products, they are particularly suitable for stabilising embankments and slopes at risk of erosion due to instability or the absence of vegetation.

The Secumat® Anchor provide a means to transmit a tensile force to a load bearing formation within the soil.

Typical Secumat® Anchor applications

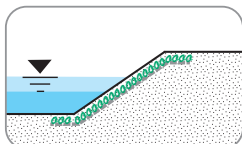


Figure 1:
Permanent erosion control by bodies of water

1. Securing trench/brook banks

Secumat® Anchors provide permanent protection for the banks around bodies of water when used as fixings for 3D meshes with geogrids and nonwoven filter materials. (Fig. 1)

2. Erosion control on technical structures

On steep-sided structures, the earth anchor systems secure the Naue erosion control mats against wind uplift and fix them to the steep surfaces. (Fig. 2)

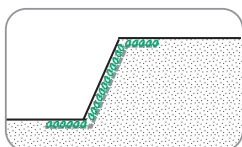


Figure 2:
Fixing on steep slope surfaces

3. Slopes on infrastructure

When using reinforced 3D mesh products in infrastructure projects, the Secumat® Anchor 100 and Secumat® Anchor 150 create a secure connection between the system and the subsoil. (Fig. 3)

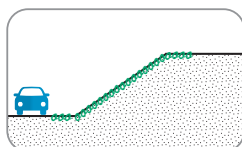
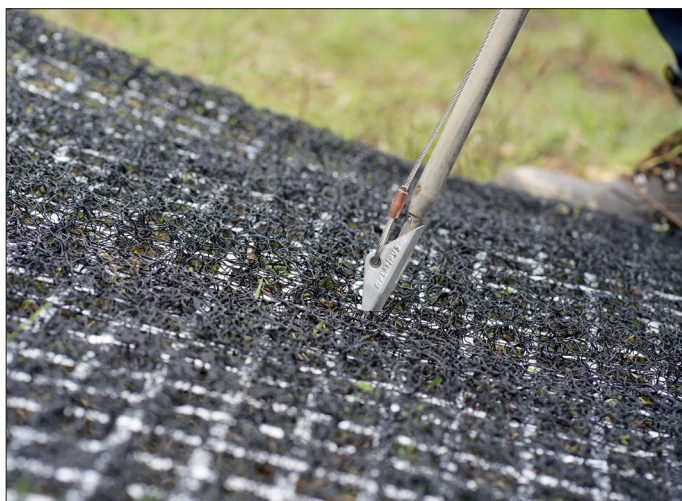


Figure 3:
Fixing the infrastructure

Benefits of using Secumat® Anchor fixings

The earth anchor system comprises a set of four individual components. It locks in place using the toggle dowel principle in which the foot of the anchor is locked and tightened using the anchor wire. The load plate is then fixed in place by the wedge grip using the anchor wire. The Secumat® Anchor effectively forms a cone of resistance in the soil and supports loads up to the load carrying capacity of the soil. The retaining forces are effective immediately.

System installation requires special tools and is completed in just a few steps.



2

Figure 4: Inserting the earth anchor system



Figure 5: Loadlocking and tensioning the earth anchor



Figure 6: Secumat® Anchor 100



Figure 7: Secumat® Anchor 150

Benefits of Secumat® Anchor 100 and Secumat® Anchor 150

- Earth anchor systems are suitable for a wide range of soil types and slope gradients. They supply immediate quantifiable loads and provide retention over a wide range of design requirements, even under particularly challenging conditions.
- Secumat® Anchor 100 and Secumat® Anchor 150 have a very long service life: They have exceptionally high corrosion resistance and are designed to meet or exceed the minimum service life of the cover material.

Secumat® Anchor packaging

Secumat® Anchors are delivered as per the table below, boxed or bagged:

Product	Property	Value
Secumat® Anchor 100	Dimension (W x L x H)	55 x 35 x 20 cm
	Weight	14 kg/box
	Quantity	100 sets/box
Secumat® Anchor 150	Dimension (W x L x H)	55 x 35 x 20 cm
	Weight	13 kg/box
	Quantity	30 sets/box

The earth anchors must be installed using specific accessories and tools and in accordance with the manufacturer's installation instructions. These are available to purchase from Naue. (Fig. 4 and 5)



Figure 8: Secumat® 401 20/20 Q1 with Secumat® Anchor 100



Figure 9: Grown through erosion control system

Approvals for the Naue Group



In partnership with



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Secumat®

Erosion Control in a Drainage Channel

Project name

Heidlandgraben, Heykenauweg, Hamburg, Germany

Products

Secumat® 601 G4

Secutex® 301 GRK 5 C





Fig. 1: Cutting of Secumat® on site



Fig. 2: „Interlocking“ of the topsoil with the artificial root network of Secumat® on the slope

Challenge

While expanding the surface drainage of an industrial area in Hamburg-Harburg, the Heidlandgraben was expanded. The cross-section of the drainage channel had to be given a larger volume in the confined space between the plots of land and thus be able to hold more capacity. For this reason, it was necessary to make the slopes relatively steep. The subgrade formed a sandy subsoil, on which the topsoil for the greening required additional support against surface-parallel erosion phenomena.

In spring, northern Germany often experiences heavy rainfall, which also in Hamburg repeatedly leads to severe erosion phenomena (e.g. groove or surface erosion) on newly formed slopes. As the construction of the new cross-section of the Heidlandgraben took place directly after the high-risk winter period, more frequent erosion damage was to be expected.

Solution

To protect the Heidlandgraben against erosion damage, the client decided to use the Naue erosion control system. A permanent erosion control mat with an extruded polypropylene monofilament core from the Secumat® product group was used.

The erosion control mat was cut to size on site to the appropriate length for the slope (plus anchor trench). Due to its low weight, the material was installed by hand. The backfilling was carried out using a long arm

excavator from the accessible side of the channel. Armourstones were placed in the bottom of the channel. To effectively prevent the sandy subsoil from being washed out through the coarse backfill even in the event of a substantial rise in the water level, a Secutex® separation and filter nonwoven was installed on the subgrade in advance.

The artificial, UV-stabilised root network of Secumat® products provided better support for the topsoil on the steeply formed slope flanks of the trench – especially during the construction phase, but also permanently after greening had taken place.

The positive effect of Secumat® was already evident during the construction phase. During heavy rainfall events, the difference between embankment areas already finished with Secumat® and topsoil and the areas not yet worked on became clear. On the slopes that had already been profiled but not yet covered with Secumat® and new topsoil, deep erosion grooves formed in some cases due to surface water collecting and running off, while the areas newly constructed with Secumat® did not show any significant erosion.

After completing the construction measure in 2007, the vegetation was able to establish itself on the embankments within a very short time. Even today, the slope flanks of the Heidlandgraben are very well protected by the installed Secumat® product and show no erosion damage.

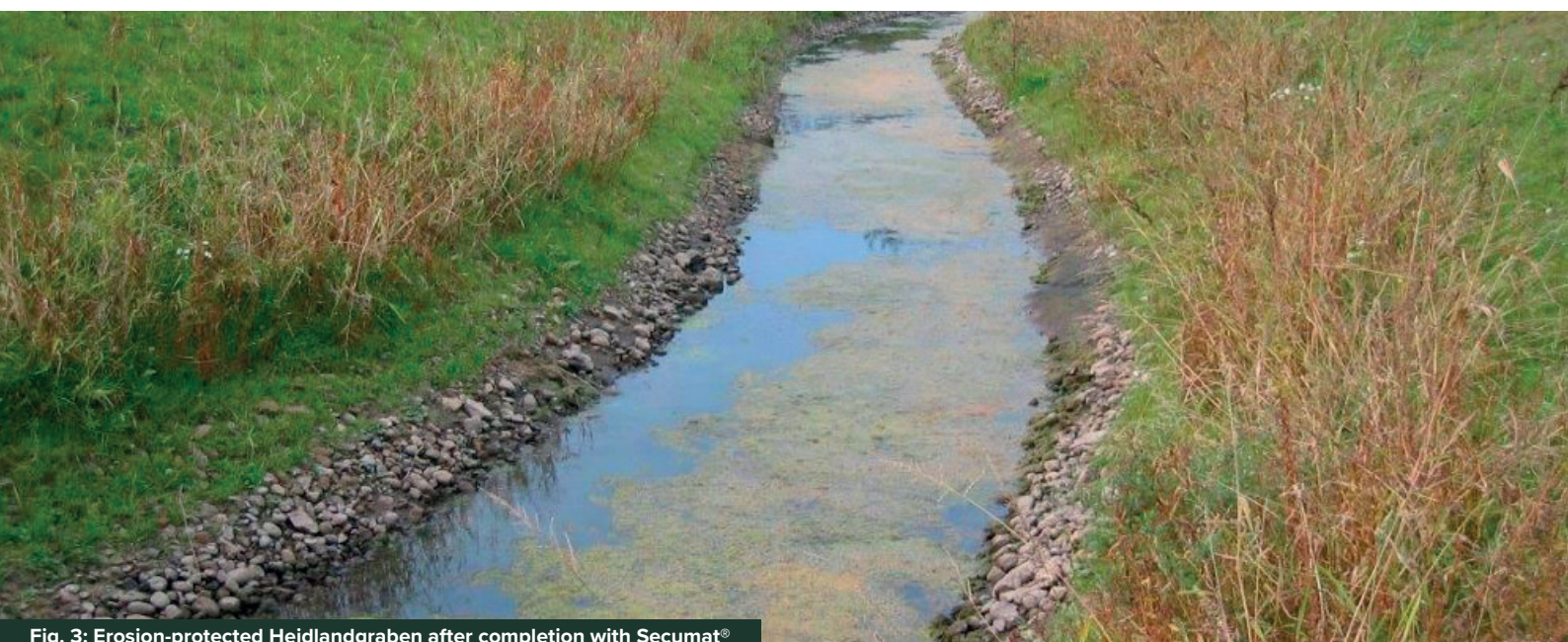


Fig. 3: Erosion-protected Heidlandgraben after completion with Secumat®

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Secumat®

Erosion control of a car park trench

Project name
Car Park, Emden, Germany

Products
Secumat® 601 201



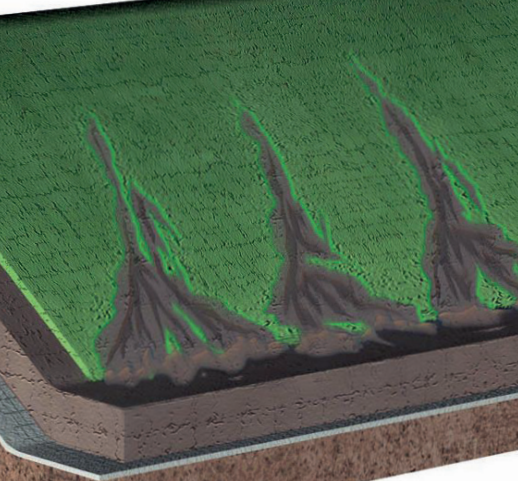


Fig. 1: Erosion on the slope

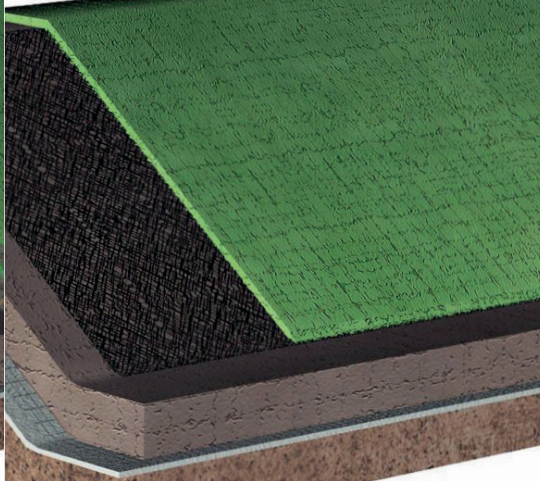


Fig. 2: Naue Secumat® erosion control system

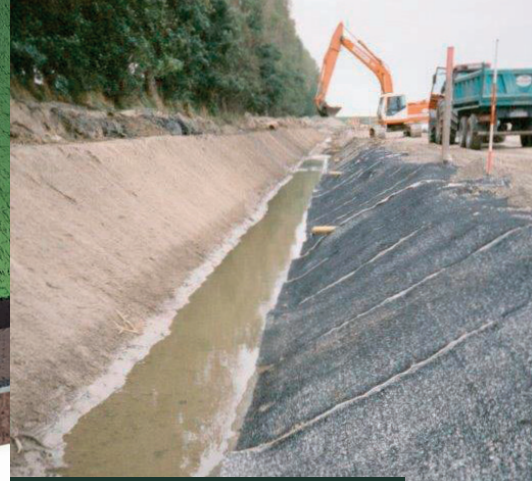


Fig. 3: Installation of the Secumat® erosion control system

Challenge

Around an approx. 50,000m² car park for new cars of a German car manufacturer, a trench was planned to collect the surface water.

To make optimal use of the available space, the slopes of the approx. 2m deep drainage trench needed to be as steep as possible. During heavy rainfall there was a risk of erosion damage of the slopes, which was further increased by the slope steepness. Surface erosion, damage to vegetation, sludge accumulation and eventually deep erosion grooves can result in unacceptable subsidence of the car park. These settlements endanger both the stability of the slope and the function of the parking area.

Solution

Erosion damage could be prevented by installing an Naue erosion control system. The contractor decided to use the Secumat® permanent erosion control mat. A two-layer combination product was used

here consisting of a three-dimensional extruded monofilament core (thickness = 20mm) with a mechanically bonded nonwoven fabric on the bottom side.

While the applied topsoil was embedded in the extruded monofilament core in an erosion-resistant manner, the nonwoven layer prevented soil particles from washing out from underneath during heavy rainfall and initial growth. At the same time, the nonwoven fabric achieved good friction behaviour of the entire system to the subsoil, which was necessary with the 1:1.5 steep slopes and the prevailing soil.

The open extruded monofilament structure favoured rapid and long-term vegetation. The Secumat® erosion control system has been in use since 2006 and protects the car park perimeter against surface-parallel erosion.

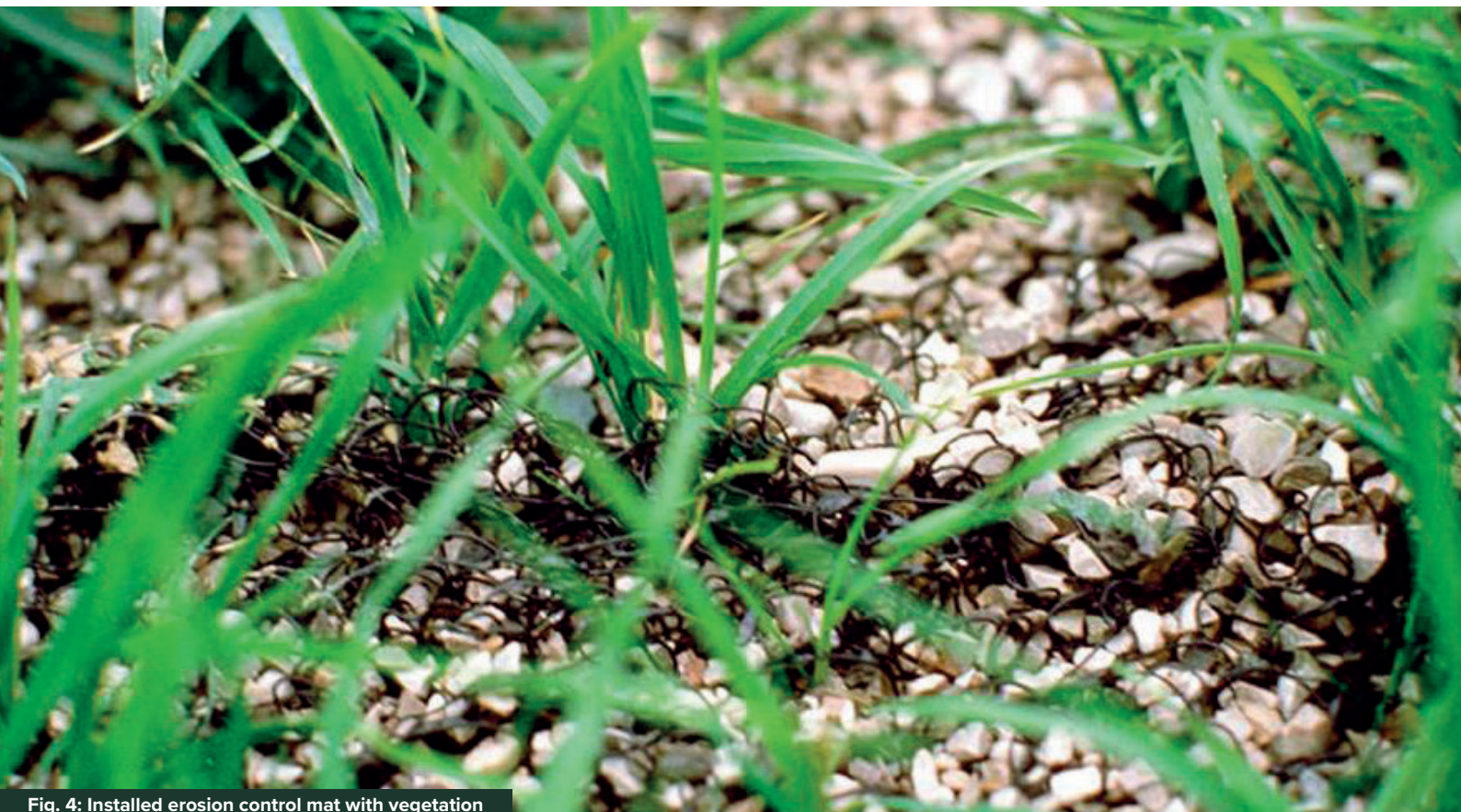


Fig. 4: Installed erosion control mat with vegetation

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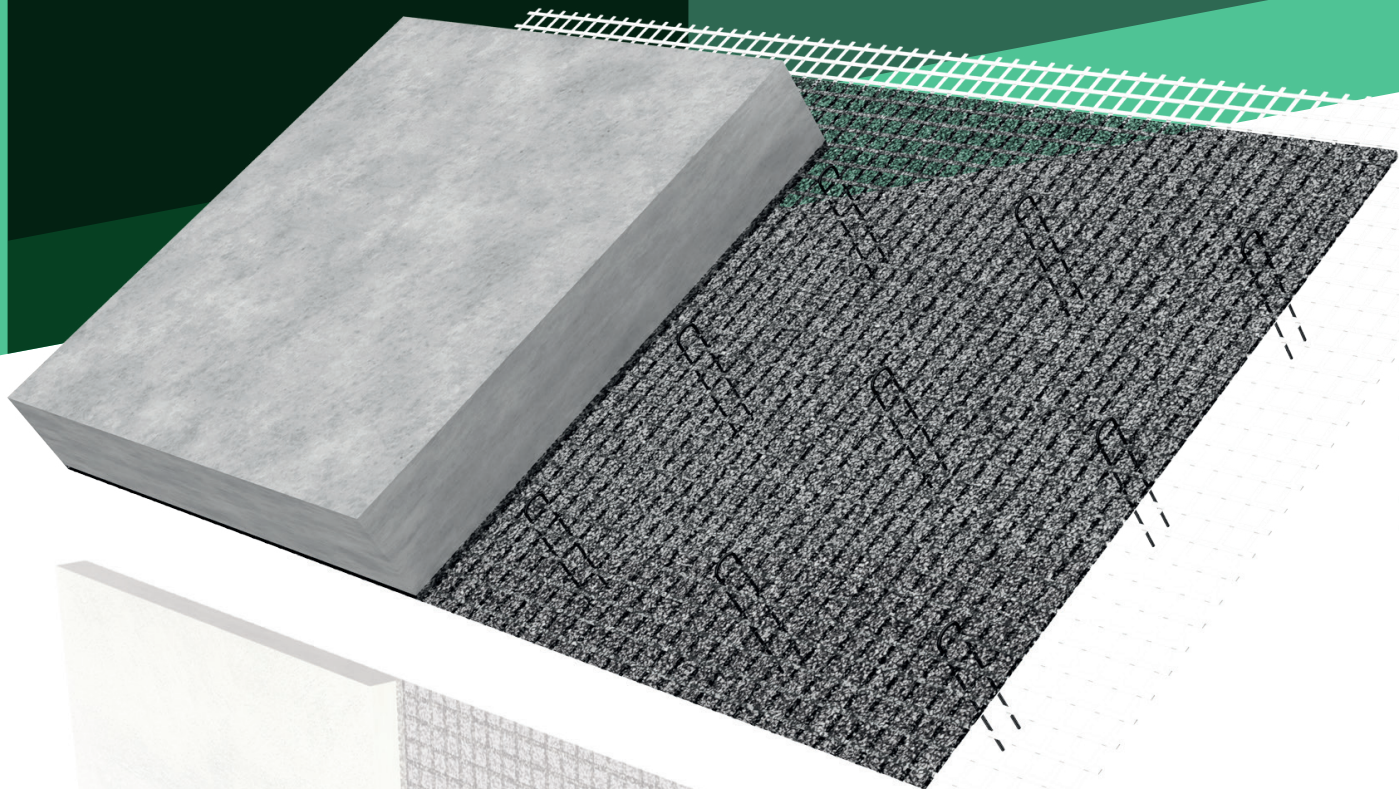
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Secumat®

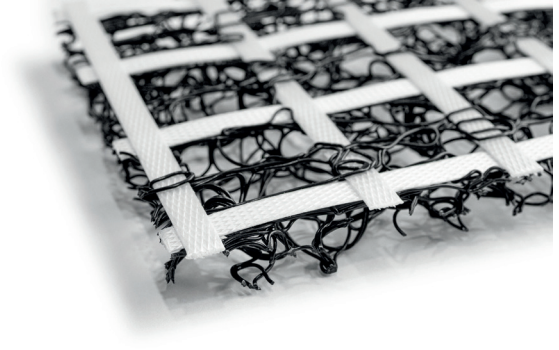
Green Skin and Desert Skin
Solution for slopes



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Building on sustainable ground.

Secumat® – three dimensional matrix for a durable soil skin



The erosion control of slopes is one of the most difficult and important aspects of engineered earth designs, but that does not mean it needs to be prohibitively expensive. Effective slope erosion control is possible through a joint utilization of soil nails and geosynthetics. This is true both for sand/cement mixtures and soil components.

Naue Secumat® 3D Mesh products has been installed since 1989 in hundreds of projects with more than 8 million m² and relies on the well-known three-dimensional erosion control matrix, Secugrid® geogrid reinforcement and the steel pin reinforcement technique. The UV-stabilised labyrinth-like extruded monofilament polymer core of Secumat® controls surface erosion and helps to anchor and reinforce the skin of the slope. The high strength Secugrid® geogrid which is integrated into the Secumat® matrix, is securely pinned into the subgrade with steel pins, while Secugrid® spans the erosion control matrix from pin to pin, avoiding soil displacement under the Secumat® matrix. The Secumat® soil skin system can be filled precisely using a minimum quantity of soil, thus utilizing local fill and limiting the need for outside soil improvement elements. However it allows other systems as well to be filled into the matrix, such as fine gravel soils or sand/cement fill materials.

Secumat® erosion control mats are used for slope and ground protection in road building, railway protection, landscaping, and landfill engineering works. Waterways engineering works employ Secumat® on flood plains, embankments, levees, canals and run-off trenches. Secumat® prevents the sliding, wind erosion and washing out of soil and cover layers while facilitating rapid vegetation growth, where green slopes and walls are desired. If cement covers are preferred, Naue's Secumat® soil skin fully supports it.

Secugrid® geogrids, which are integrated into the Secumat® erosion control, are part of the new generation of geogrids and are manufactured with high tensile, monolithic reinforcing bars that provide high strength at low strains – the bar by which geogrids are often judged. Typical applications for Secugrid® include subgrade reinforcement, embankment stabilization, mechanically stabilized earth (MSE) constructions, steep slope stabilization, earth dam reinforcement, foundation support, and many other installations. Benefits of the reinforced Secumat® three dimensional erosion control matrix for a durable soil skin are:

- Effective, economical, quick and easy-to-install steep slopes
- Guards against landslides, water and wind erosion
- Supports cement and green walls
- Exceptional erosion control for new construction
- Repairs damaged slopes, including postfire remediation
- Protects roads, railways and other transportation infrastructure
- Utilizes local fill
- Reduces transportation costs of materials to site
- Protects slopes up to 75°, design-depending

Whether Secumat® is vegetated or covered by cement/sand, heavy rain, wind attack and surface water flow does not deter the soil retention ability of Secumat®. The system can prevent erosion through the reduction of runoff velocities and discharge and increase infiltration. Directly next to waterways, Secumat® can protect the banks from water flow scour.



2 Figure 1: Erosion control on street slopes



Figure 2: Vegetated slopes



Figure 3: Secured highway slopes

System1 Green Skin

System2 Desert Skin

Vegetated slopes (System 1 Green Skin)

When slopes involve angles up to 1:1.5, Secumat® can provide outstanding erosion control and vegetation. The slope surface, protected by Secumat® erosion control mats, can be filled with site-applicable topsoil, including hydroseed. The flexibility of the system and environmental utilization of local materials allows for significant adaptation to unique site conditions with minimal land disturbance needs. This includes flattened, prepared slopes and rougher, less prepared slopes. Secumat®'s open structure allows soil filling over its entire area and depth. Secumat® thus retains surface water and prevents erosion. Root development is supported by the three-dimensional structure of Secumat® adding to the strength of the vegetative protection, when vegetated walls and slopes are desired. It is chemically and biologically resistant to natural soil substances and extremely resistant to UV radiation, meaning that when initially installed and exposed and awaiting vegetation the material will survive without impacting long-term performance.

Dry and unvegetated slopes (System 2 Desert Skin)

Green walls and slopes are common applications now, but they are not appropriate for all sites. Some sites perform best and are most economical for clients with cement/sand covers. And the main advantage: in most cases local sand can be used for mixing with the cement. In these instances, Secumat® supports them in the same way it does vegetated walls: with an exceptional erosion control structure and long-term performance.

Benefits of Secumat®

Secumat® can be installed quickly and safely with significant environmental and cost savings. The ability to utilize local site materials in combination with site-appropriate growth mediums (such as hydroseed) or cement applications drastically reduces costs through not requiring so much expensive fill. In addition to being a clear site savings from an economic standpoint, this is also a much-welcomed environmental savings by greatly reducing heavy truck traffic to the site. Also, the ability to utilize economical technologies such as hydroseeding significantly increases site installation time windows without sacrificing quality or safety. The Secumat® erosion control matrix system allows for the securing of slopes quickly, effectively, safely and within budget. The lightness and durability of both Secumat® and Secugrid® rolls enable rapid, inexpensive installations.

Advantages of Secumat® 3D-Mesh

- Applicable in many geotechnical applications
- Easy soil filling, even in steep slopes
- Excellent soil retention capacity in three dimensional matrix
- Supports root growth
- Reduces soil erosion due to rain and wind
- Long-term durable polymeric structure
- Easy handling of light weight rolls
- ISO 9001, ISO 14001 and ISO 50001 certified



Figure 4: System Green Skin



Figure 5: Erosion control under construction



Figure 6: Erosion control vegetated



Manufactured
in Germany



Effective
handling



Simple
loading



Easy
cutting



Fits after
unrolling



Withstands
walking stress



Easy
filling



Difficult
structures possible

Approvals for the Naue Group



For further information or queries, please contact the planners, designers or Naue GmbH & Co. KG directly.

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1. Area of application

These installation instructions apply when using Naue products of the type Secumat® only. Naue offers temporary and permanent Secumat® erosion control systems.

2. Applications

Secumat® erosion control systems are designed for short to medium-term or for long-term functional erosion control close to the surface and are intended to reduce or prevent surface erosion by external influences, particularly by weather such as rainfall and wind. They also strengthen the root development of any seeds or plants introduced during the initial planting of vegetation and in the long term.

Application areas include slopes:

- in building construction and civil engineering
- in garden projects and landscaping
- in water and pond-based construction
- in renaturalisation
- on landfill site surfaces

3. Quality declaration

Naue GmbH & Co. KG is committed to thorough and complete quality control. This commitment starts by checking all raw materials, individual components and the finished product, and continues until the customer takes delivery of the Secumat® goods. Naue GmbH & Co. KG is certified to ISO 9001.

4. Transportation and storage

4.1 Protective wrapping

Secumat® geosynthetic systems are produced in rolls and are packaged with a protective wrapping for protection against weather during transportation and storage. Care should always be taken to ensure the protective wrapping on the roll is not damaged. Minor damage to the packaging wrapping must be repaired with a weather-resistant adhesive strip. The protective wrapping should only be removed just before installing the roll.

Secumat® natural fibre systems intentionally do not have a protective wrapping to ensure the rolls can breathe which prevents water logging. In spite of their high resistance to environmental influences, the rolls should not be stored for long periods without protection.

These installation instructions contain only general recommendations and do not replace implementation planning. This may result in significant deviations as a result of tender or specific project requirements which take precedence over these instructions. These instructions do not cover all possible safety concerns associated with the use of the product. The user is responsible for ensuring appropriate health and safety measures are in place and for determining and meeting possible legal or regulatory legislation and requirements.

Furthermore, these installation instructions do not cover all possible climatic, chemical, physical, hydraulic or geometric boundary conditions on the building site.

The information provided in these installation instructions corresponds to the most up-to-date level of knowledge of Naue GmbH & Co. KG at the time this document is produced. We reserve the right to make amendments. Please make sure you are fully aware of the relevant technical level of knowledge at the time of installation.

The customer is responsible for checking the accuracy and completeness of the information contained in these installation instructions with respect to all issues related to the application. Naue GmbH & Co. KG accepts no liability for incorrect use of the product in an application. This also excludes any liability for errors in these installation instructions.

4.2 Unloading

Secumat® products are to be unloaded from the truck using suitable equipment (planking or hoist). Rolls ≤ 2 m wide can be manually unloaded by a person providing the permissible safe working load is observed. Rolls should not be thrown from the truck and this is therefore not permitted.

4.3 Storage

Secumat® geosynthetic systems do not require special protection from rain. The rolls can be stored horizontally or vertically. The rolls may not be weighted down. A maximum of three layers can be stacked on top of each other. Natural fibre systems should be protected from rain and stored horizontally. The substructure should be flat, dry and free of foreign matter. Secure stacked rolls against settling, rolling away or falling (Fig. 1).

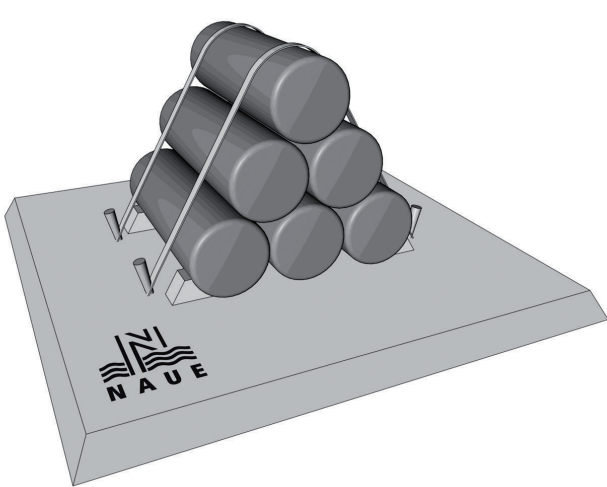


Fig. 1 Stacking and securing Secumat®

5. Surface preconditions

The most effective results are achieved with Secumat® when it is in direct contact with the ground. When preparing the surface, for example on the slope, the conditions stated in the tender such as compaction or type of soil, must be maintained (Fig. 2). The surface must be flat, compacted if necessary, and free from sharp objects, large, protruding individual particles, and offsets. The building contractor and/or the relevant planner is responsible for ensuring the substructure meets the requirements and is approved before installing the Secumat® system. Once prepared, the surface should not be driven over again.

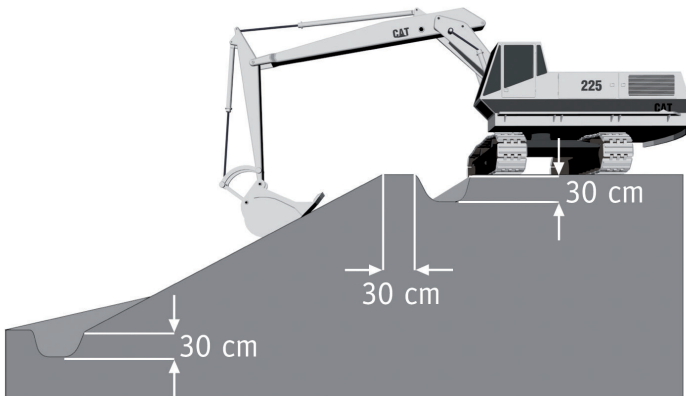


Fig. 2 Preparation and levelling of the surface before installing Secumat® (anchorage trench at the top of the slope and at the bottom of the slope as well, if necessary, in accordance with the tender specifications)

6. Installation

6.1 Handling the rolls correctly

Secumat® rolls can be installed quickly and easily. The safety provisions of the installation equipment must be taken into consideration. The factory packaging (protective wrapping) on the Secumat® geosynthetic systems may only be removed immediately before installation.

6.2 Planning regulations

The construction company carrying out the work should ensure, in consultation with the engineering office inviting tenders, that the planning regulations (e.g. slope inclination, anchorage trench, etc.) are complied with before the Secumat® erosion control system is installed.

6.3 Unrolling Secumat®

Secumat® rolls must be fixed at the top of the slope as shown in Figures 3–7 before unrolling down the slope, particularly if an anchorage trench is not required. To produce a functional Secumat® erosion control system, the Secumat® roll must be fixed with Secumat® fixings once unrolled. The erosion control systems must lie flat and be in direct contact with the surface throughout. There must not be any ripples in the rolls. The rolls may also in principle be unrolled perpendicular to the slope.

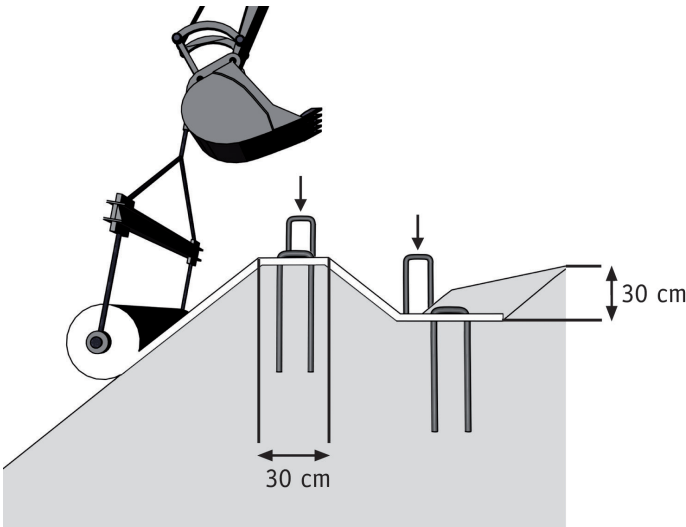


Fig. 3 Installing Secumat® from the top of the slope. We recommend fixing at the top of the slope. When using Secumat® with reinforcement components, we recommend filling the anchorage trench.

Secumat® erosion control fixings	Secumat® Green PinW 30	Secumat® PinU 23	Secumat® Anchor 100	Secumat® Anchor 150
Binding length	27 cm	21 cm	50 cm	75 cm
Product design	Pointed pin with crosspiece	Pointed symmetrical U-shaped staple	Four-pronged ground anchor	Four-pronged ground anchor
Material	Beech	Steel	Corrosion-resistant	Corrosion-resistant

Table 1 Typical fixings for securing Secumat® on the surface

Note: Secumat® must not be driven on directly. Driving on the surface should also be avoided as this can produce irregularities. These precautions protect the Secumat® system from potential damage and ensure the installed material has optimum contact with the surface.

The anchorage trench must be filled and compacted in accordance with the tender before adding the soil to the Secumat®. The rest of the soil can then be added to the surface.

6.4 Erosion control fixings

Secumat® should be fixed with Secumat® fixings on slope gradients > 1:5 (see Figures 3–7). Fixing should always be completed before introducing soil or vegetation. On slopes with a gradient steeper than 1:1.5, the fixings should be closer together (see Appendix Geosynthetic systems and natural fibre products) and agreed with the tendering authority. In some applications, the addition of an integrated Secugrid® geogrid to the Secumat® 3D mesh can improve the erosion control and stability. Overlaps/joints must be secured with fixings. The length of the fixing is dependent on the soil conditions and should be agreed with the engineering office inviting tenders if necessary before installation. See Table 1 for details of securing the erosion control system.

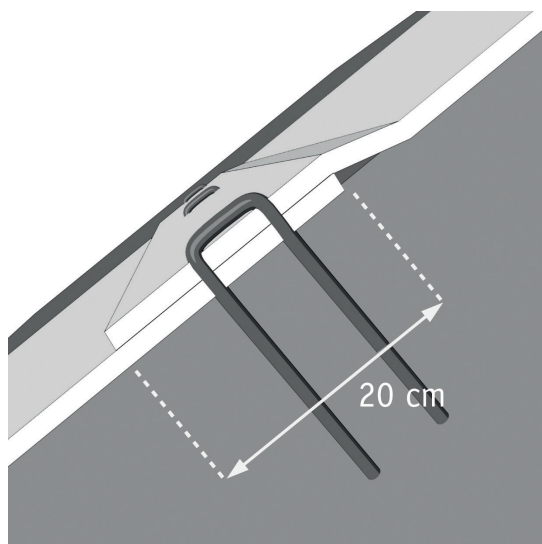


Fig. 4 Securing the Secumat® erosion control system overlap perpendicular to the downward slope direction

Fixing provisions for Secumat® in flow areas are determined by the shear stresses and flow velocities. The fixing pattern in Table 2 can be used for low flow velocities; at greater flow velocities, the fixings are to be placed closer together at a distance agreed with the tendering authority.

Secumat® products	Specific installation information
Secumat® natural fibre products	See Appendix Natural fibre products See Appendix Rolls
Secumat® geosynthetic products	See Appendix 3D mesh products See Appendix Geocells
Secumat® fixing	See Appendix Ground anchors

Table 2 Typical fixing pattern

6.5 Overlap

Rolls installed side by side can be butted up to each other or with a 10 cm overlap (see Figures 5 & 6).

The ends of rolls must be overlapped on a slope in the downward direction like roof tiles. The overlap should be at least 20 cm wide (Fig. 4) and be fixed every 50 cm with Secumat® fixings (Fig. 5).

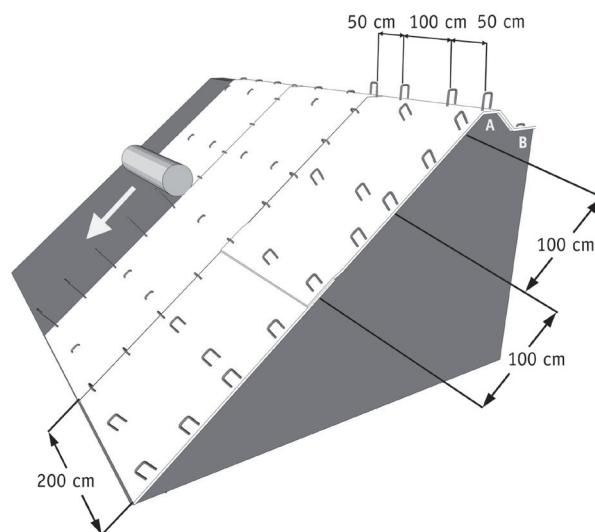


Fig. 5 Typical fixing arrangement on slopes with erosion control systems installed edge to edge

In areas which have a flow of water, the lengths of Secumat® must be overlapped in the direction of flow (min. 10 cm). The overlaps must be secured with fixings at a minimum of every 50 cm.

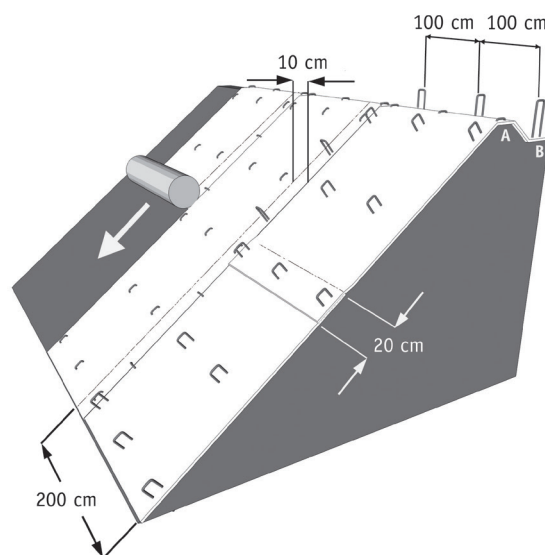


Fig. 6 Typical fixing arrangement on slopes with overlapping erosion control systems

6.6 Cutting the rolls to size and finishing

Secumat® can be cut and finished with standard cutting equipment such as electric shears or textile shears. The material can be cut to size directly on site, for example, to suit the length of the slope (at the base or top) or to accommodate openings for pipes.

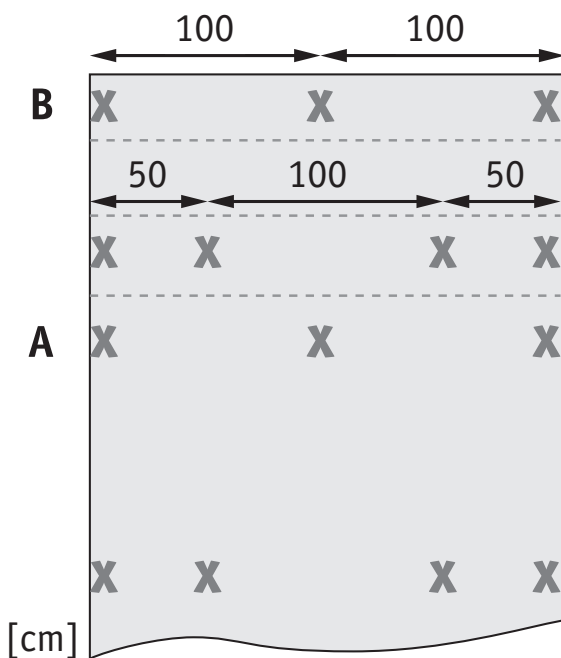


Fig. 7 Securing with fixings at the top of the slope and in the anchorage trenches (see also Fig. 5 and Fig. 6).

Additional fixings are required near the openings to secure the Secumat® to the ground (approx. every 25 cm) and to ensure a good bond with the surface. If spacers are used, these should also be fixed at a distance of approx. every 50 cm, particularly in the overlapping areas.

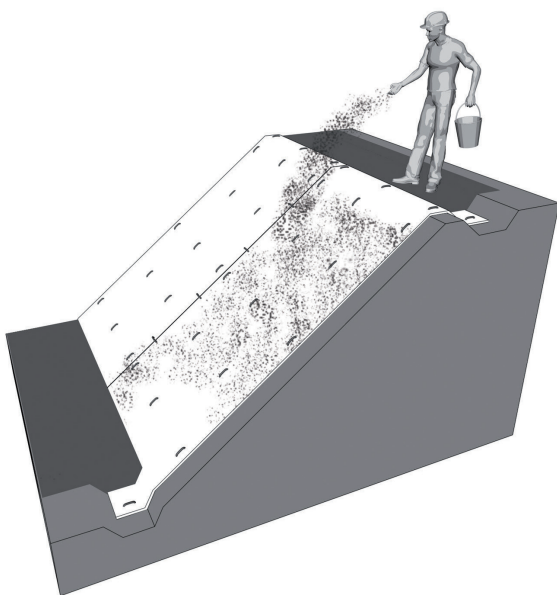


Fig. 8 Sowing seeds into the Secumat® erosion control system

7. Filling with soil

Once rolled out and secured with fixings, Secumat® immediately acts as a fully functional Secumat® erosion control system. Soil or vegetation (including scatter planting and other planting options) can be introduced immediately after anchoring (Figures 7 & 8).

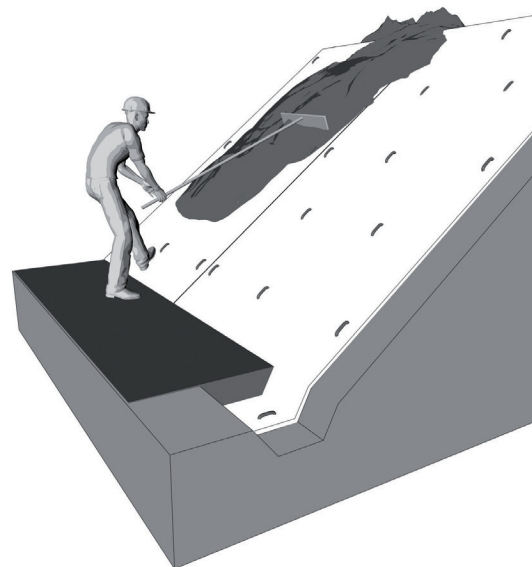


Fig. 9 Manually adding the soil to the Secumat® erosion control system

On the slope, the soil should be introduced from the bottom of the slope to the top. Geosynthetic systems which combine Secumat® and Secugrid® geogrids can be filled from the top downwards once the slope stability has been checked (see Figures 9 & 10).



Fig. 10 Adding the soil using machinery

This assessment of the slope stability should consider all factors, e.g. soil parameters, gradient, length of slope, soil type, superimposed load, static and dynamic loading etc. The backfill soil should be introduced slowly, carefully and with the aid of a rake or machinery. Secumat® Erosion control systems without additional reinforcement by Secugrid® geogrids are not suitable for constructions with high forces in the downward slope direction (e.g. from added soil or vehicular traffic). Large quantities of soil may not be stored on the slope on top of Secumat® without safeguards in place. We recommend a uniform covering layer of vegetation is introduced as a matter of urgency. In any case, care should be taken to ensure the Secumat® is neither displaced nor damaged while the soil is being put in place.

The local soil conditions should promote rapid vegetative growth. The seed mix should be adapted to the tender requirements and the local climatic conditions. Watering to suit the specific locality and fertilising the soil will promote rapid growth.

Heavy run-off of rainwater over the Secumat® during the vegetative growth phase should be prevented in order to stop the backfill soil from being flushed away or undercut. Small embankments should be put up on the top of the slope to ensure water flows away through pipes or to non-critical areas.

8. Repair

Secumat® areas which have been damaged during installation can either be covered or replaced with new Secumat® material. New Secumat® erosion control systems must overlap adjacent Secumat® areas by at least 20 cm and be secured in place with fixings before backfilling with soil (Fig. 11).

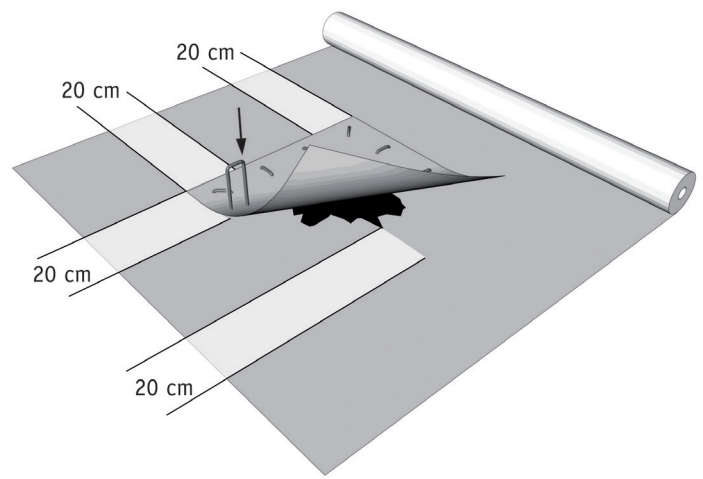


Fig. 11 Repairing damaged Secumat® erosion control system

9. General information

Secumat® geosynthetic systems are permanently resistant to all chemical and biological attack naturally occurring in the soil and support long-term root growth. They therefore offer effective erosion control. Biodegradable natural fibre Secumat® systems are intended for temporary erosion control. Secumat® can be installed quickly and economically and provides rapid greening, even on steep slopes.

We reserve the right to make product changes and amendments to these installation instructions. These installation instructions correspond to the latest state of the art. Any deviations from the installation instructions must be agreed with the manufacturer. No derivative warranty claims allowed.

Naue Secumat® erosion control system

Geosynthetic systems:

- Easy to install, UV-stable 3D erosion control mesh for long-term functionality
- Supports root growth and stabilises the soil surface
- Reduces subsequent costs from soil erosion and plant damage
- Available with optional Naue Secumat® PinU 23 system
- Permanent

Natural fibre systems:

- Made from woven renewable raw materials, biodegradable natural fibres for temporary erosion control
- Protects plant growth at the germination stage and the vegetative phase
- Reduces subsequent costs from soil erosion and plant damage
- Available with optional Naue Secumat® Green PinW 30 system
- Temporary

Secumat® installation instructions

Natural fibre products

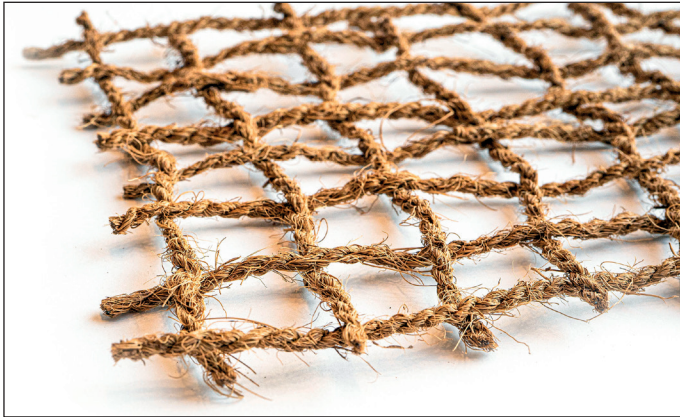


Fig. 1 Secumat® Green Coco N 400 20x30



Fig. 2 Secumat® Green Coco N 900 10x15

Natural fibre products are:

- supplied rolled
- structurally fixed on the upper and lower edge if necessary
- secured to the surface with fixings

Natural fibre product	Preferred fixing	Other fixing options
Secumat® Green Coco N 400 20x30	Secumat® Green PinW 30	Secumat® PinU 23
Secumat® Green Coco N 700 15x20	Secumat® Green PinW 30	Secumat® PinU 23
Secumat® Green Coco N 900 10x15	Secumat® Green PinW 30	Secumat® PinU 23
Secumat® Green Coco M 450	Secumat® Green PinW 30	Secumat® PinU 23
Secumat® Green Jute N 500 20x30	Secumat® Green PinW 30	Secumat® PinU 23

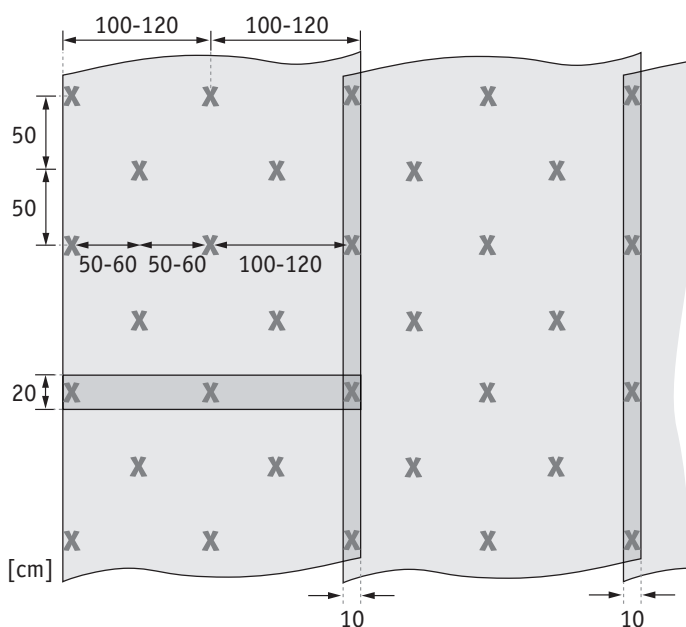


Fig. 3 Fixing pattern for slopes from 1:5 to 1:1.5.

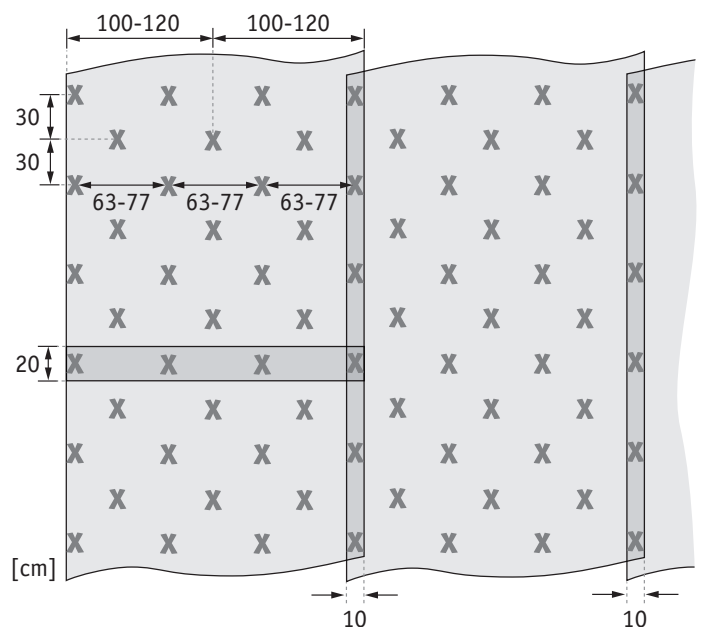


Fig. 4 Fixing pattern for slopes $\geq 1:1.5$.

Secumat® installation instructions

3D mesh products and Secugrid® reinforced 3D mesh products



Fig. 1 Secumat® 601 G4



Fig. 2 Secumat® 401 20/20 Q1

3D mesh products are:

- supplied rolled
- structurally fixed on the upper and lower edge if necessary
- secured to the surface with fixings
- covered with soil once installed

3D mesh product	Preferred fixing	Other fixing options
Secumat® 401 G4	Secumat® PinU 23	Secumat® Green PinW 30
Secumat® 601 G4	Secumat® PinU 23	Secumat® Green PinW 30
Secumat® 401 20/20 Q1	Secumat® Anchor 100 Secumat® Anchor 150	Secumat® PinU 23
Secumat® 601 40/40 Q6	Secumat® Anchor 100 Secumat® Anchor 150	Secumat® PinU 23

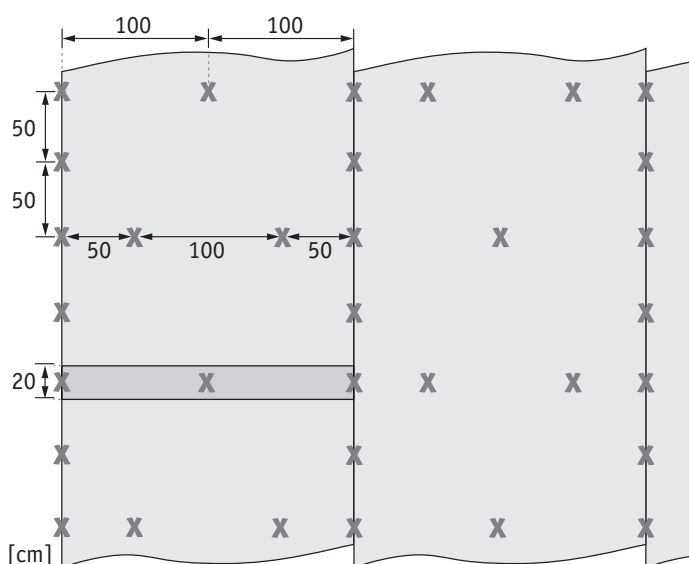


Fig. 3 Fixing pattern for slopes from 1:5 to 1:1.5

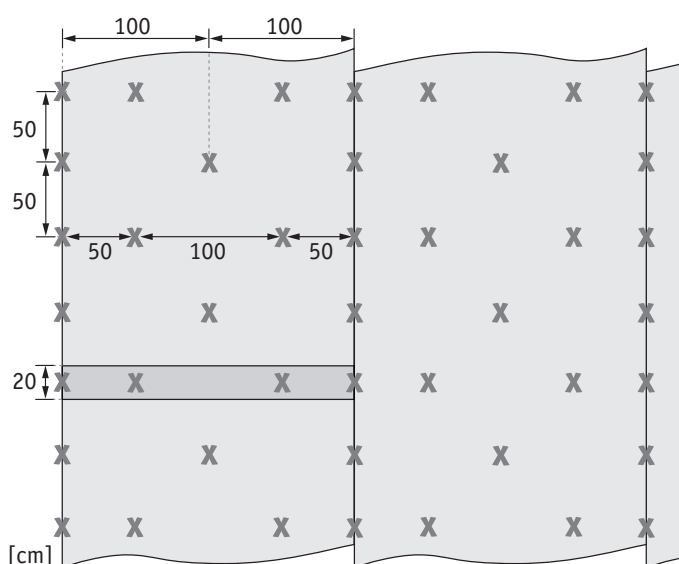


Fig. 4 Fixing pattern for slopes $\geq 1:1.5$

Secumat® installation instructions

Earth anchor system



Fig. 1 Secumat® Anchor 100

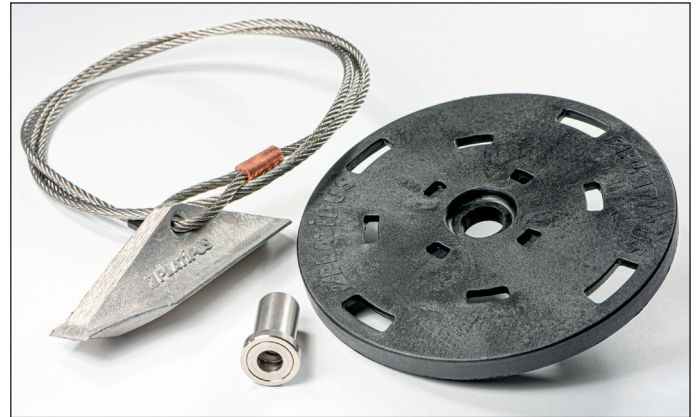


Fig. 2 Secumat® Anchor 150

Secumat® Anchors are:

- installed using specific accessories and tools. The installation tools are available on request.
The following should be used:
 - when using a hand drive rod:
a common sledgehammer/heavy-duty hammer
 - when using a power drive rod:
an electric/petrol/pneumatic percussive hammer
- installed on site using a defined fixing pattern specific to the project Figure 3 shows a typical pattern.
- are primarily used to fix Secumat® 3D mesh products reinforced by Secugrid®: they are inserted into the slope with the reinforcing element underneath. They are also used to fix combinations of individual products from, for example, the Secumat®, Secugrid® or Carbofol® product ranges.
- finally, covered with soil

Earth anchor pattern:

Each project must be planned and adapted to its own specific fixing pattern. Secumat® PinU 23 can be used as an optional supplement to ensure small scale contact between the erosion control product and the subsoil.

3D mesh product	Preferred fixing
Secumat® 401 20/20 Q1	Secumat® Anchor 100 Secumat® Anchor 150
Secumat® 601 40/40 Q6	Secumat® Anchor 100 Secumat® Anchor 150
Secumat® 401 G4 or 601 G4 with Secugrid®	Secumat® Anchor 100 Secumat® Anchor 150

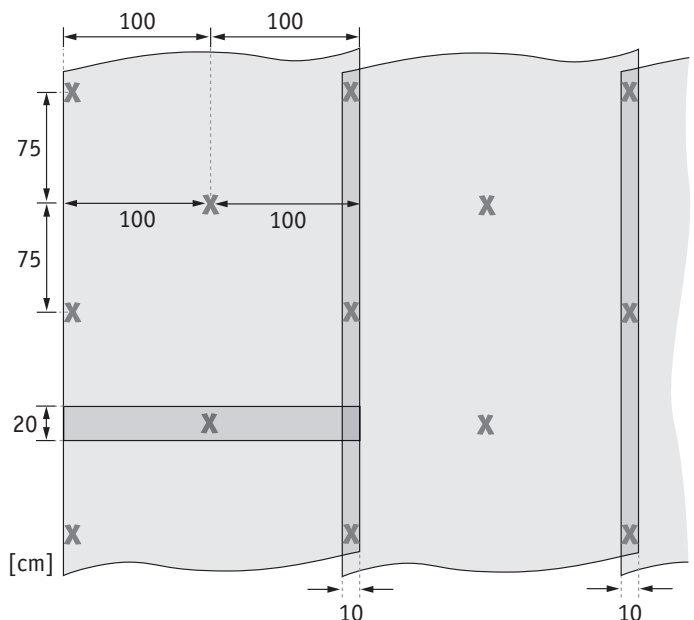


Fig. 3 Example of a Secumat® Anchor 100 and 150 fixing pattern

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Secumat® installation instructions

Earth anchor system

Installation of Secumat® Anchor 100 and Secumat® Anchor 150

- 1** Insert the anchor foot into the substructure using either a hand or power drive rod



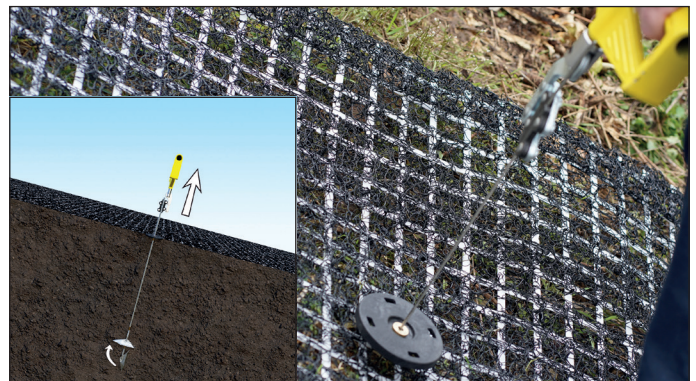
- 2** Extract the drive rod by hand or using rod removers



- 3** Thread the load plate and wedge grip onto the wire



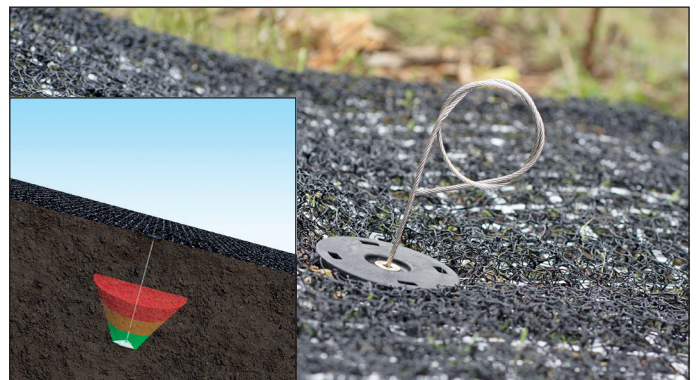
- 4** Tension the earth anchor wire using the loadlocking clamp: this rotates and locks the earth anchor in the subsoil



- 5** Stress the earth anchor wire using the manual stressing jack



- 6** The earth anchor is installed and fully functional*



* If the earth anchor wire is retained on site, the earth anchor can be retensioned; alternatively, the wire can be cut flush with the load plate.

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PLATIPUS
EARTH ANCHORING SYSTEMS



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Secumat® installation instructions

Geocell products



Fig. 1 Secumat® Cell 100

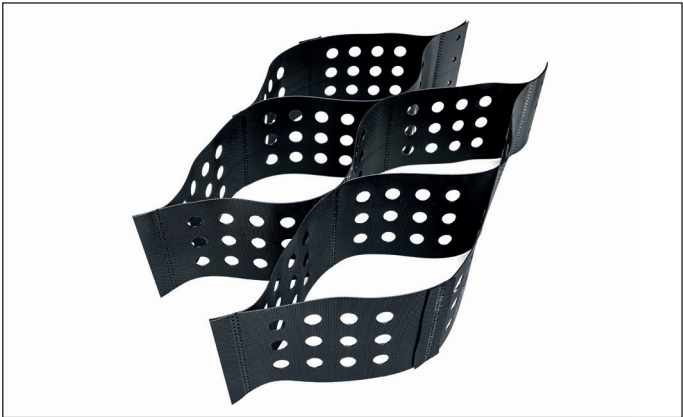


Fig. 2 Secumat® Cell 150

Geocells are:

- made up of sections
- structurally fixed on the upper and bottom edge if necessary
- fixed to each other section
- secured to the surface with fixings
- covered with soil once installed

Geocell products	Preferred fixing
Secumat® Cell 100	Secumat® Screw Secumat® PinCap
Secumat® Cell 150	Secumat® Screw Secumat® PinCap

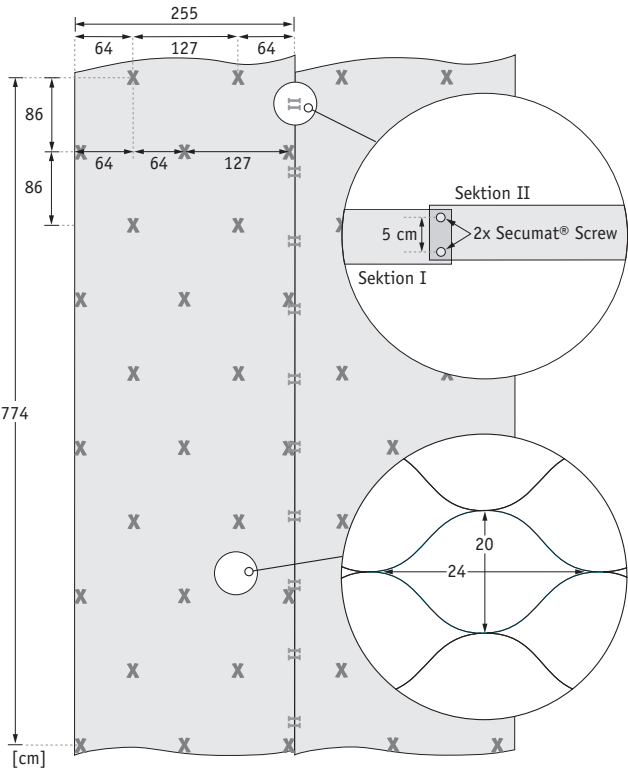


Fig. 3 Example of a Secumat® PinCap fixing pattern for Secumat® Cell 100 each overlaying and fixed in place with two Secumat® Screws where the sections meet

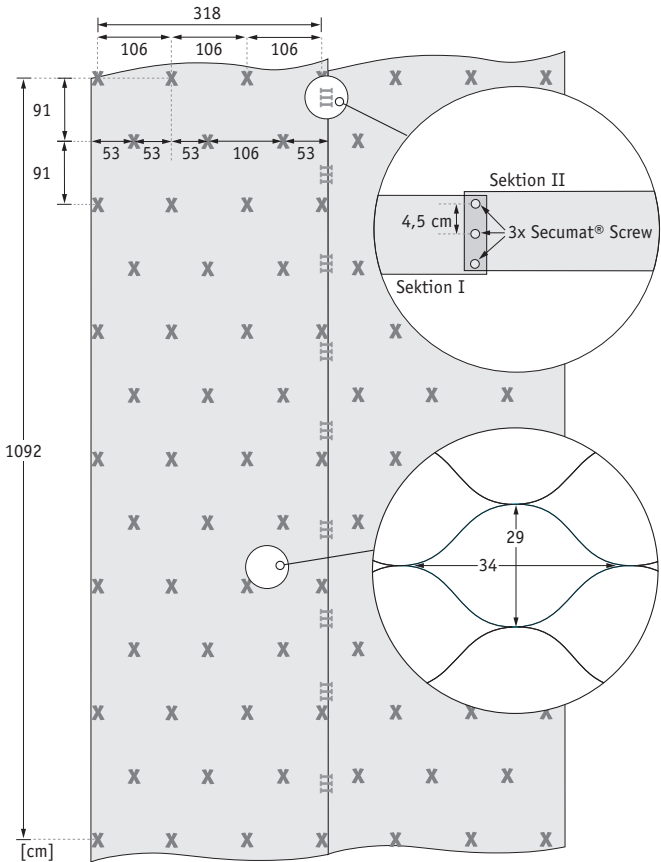


Fig. 4 Example of a Secumat® PinCap fixing pattern for Secumat® Cell 150 each overlaying and fixed in place with three Secumat® Screws where the sections meet

Secumat® Verlegeanleitung

Geozellen

Einbau des Secumat® Cell 100 und Secumat® Cell 150

1 Planum vorbereiten

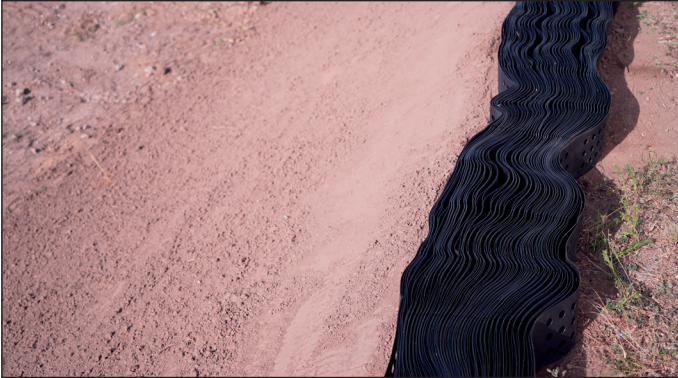


Abb. 5 Aufgefalteter Sektionenstrang an der Böschungskrone

2 Anlegen der Secuma® Cell der Kopfplatte und Anbringen der Spannhülse*



Abb. 6 Vormontierte Befestigungen an der Böschungskrone

3 Ausfalten der Sektion



Abb. 7 Verlegen der Geozellensektion hangabwärts

* Für die Fixierung der Secumat® Cell kann ein Einbindegraben vorgesehen werden. Der Einbindegraben ist gemäß der Bemessung auszugestalten.

Planum

Die **Secumat® Cell** Geozelle ist im direkten Kontakt mit dem Untergrund am wirkungsvollsten. Bei der Vorbereitung des Planums (z.B. an der Böschung) müssen die in der Ausschreibung genannten Anforderungen, z.B. an Verdichtung oder Bodenart, eingehalten werden. Das Planum muss eben, ggf. verdichtet und frei von scharfen Gegenständen, großen herausragenden Einzelkörnern und Versätzen sein. Es obliegt der Verantwortung des Bauunternehmers und/oder des zuständigen Planers, dass der Untergrund den Anforderungen entspricht und vor Verlegung von **Secumat® Cell** freigegeben ist. Das vorbereitete Planum sollte nicht mehr befahren werden.

Anlegen

Ein Sektionenstrang der **Secumat® Cell** wird oberhalb der Böschung angelegt. Zur Befestigung an der Böschungskrone wird das Befestigungssystem **Secumat® PinCap** und Baustahl im Abstand Zellentasche-zu-Zellentasche in den Boden vorfixiert, so dass für jede Zellentasche ein Baustahl im Boden vorfixiert ist.

Bei der **Secumat® Cell 100** entsprechen es zehn (2,6 m mit einem Abstand von 20 cm), bei der **Secumat® Cell 150** neun (2,8 m mit einem Abstand von 30 cm) vorzumontierenden Befestigungen. Dabei wird die Zellentaschenmitte als Ausgangspunkt gewählt, um eine optimale Kraftverteilung zur Befestigung zu garantieren. Nachdem die Baustähle vormontiert wurden, wird der **Secumat® Cell** Sektionenstrang aufgefaltet und die an der Böschungskrone befindlichen Zellentaschen, jeweils über den Baustahl gelegt. Die **Secumat® PinCap** fixiert Baustahl mit Zellenwand zum Untergrund.

Ausfalten der Sektion

Die an der Böschungskrone fixierte Geozelle wird hangabwärts verlegt. Es wird empfohlen die an den Rändern befindlichen Zellentaschen mit Füllmaterial vorzufüllen, um eine einfache und schnelle Installation zu erreichen. Die Sektionlänge sollte nicht über die vorgegebene Länge hinaus beansprucht werden.

Secumat® Cell können in einer Rundung verlegt werden, dabei ist darauf zu achten, dass die Zellen weder gestreckt noch gestaucht werden. Besser ist es, die Zellen so zuzuschneiden und miteinander neu zu verbinden, dass eine ideale Aufspannung bei jeder Zellentasche gegeben ist.

Secumat® Verlegeanleitung

Geozellen

Einbau des Secumat® Cell 100 und Secumat® Cell 150

4 Befestigung mit dem Boden



Abb. 8 Fixierung der Geozelle auf der Böschung

5 Befüllen der Geozelle



Abb. 9 Füllung der Geozelle

6 Sektionenverbindung



Abb. 10 Anschließen einer weiteren Sektion

Flächiges Befestigen der Sektion

Die **Secumat® Cell** wird flächig mit weiteren Befestigungssystemen, bestehend aus Baustahl und **Secumat® PinCap**, manuell oder maschinell, permanent fixiert, siehe Befestigungsmuster. (Abb. 3 oder Abb.4)

Befüllen der Geozelle

Nachdem die **Secumat® Cell** auf dem Planum fixiert ist, kann die Befüllung von Böschungskrone hangabwärts durchgeführt werden. Die maximale Fallhöhe des Füllmaterials sollte 1 m nicht überschreiten. Eine kontrollierte Überfüllung der Zellen ist erforderlich, um Konsolidierung und Verdichtung des Füllmaterials zu ermöglichen. Die Füllung sollte bündig mit Oberseite der Zellenwände bei Abschluss der Installation sein. Vorteil der **Secumat® Cell** ist, dass sowohl Mutter-, rundkörniger, gröberer Boden oder Zement eingefüllt werden kann.

Sektionenverbindung

Sektionen werden mittels **Secumat® Screw** verschraubt. Die Kanten der aneinandergrenzenden Sektionen werden ausgerichtet und verschränkt. Dabei sollte sichergestellt werden, dass die Oberseiten der angrenzenden Sektionen bündig sind.

Die **Secumat® Screw** wird an den Seite-zu-Seite Verbindungen, also in der Überlappung von der Böschungskrone herab, oder an den Ende-zu-Ende Verbindungen, also quer zur Böschungsrichtung, platziert und verschraubt.

Bei einer Seite-zu-Seite Verschraubung sollte die Befüllung erst nach vollständiger Fixierung der Sektionen untereinander durchgeführt werden.

Bei einer Ende-zu-Ende Verschraubung sollte die angelegte Geozelle erst nach Fixierung der Schraubverbindung ausgefaltet werden.

Secumat® installation instructions

Roll products



Fig. 1 Secumat® Green Coco R 30



Fig. 2 Secumat® Green Coco R 30

Rolls are:

- laid out
- fixed on site if necessary either through or in front of the product
- stacked if necessary

Natural fibre product	Preferred fixing	Other fixing options
Secumat® Green Coco R 30	Wooden stake	Wooden boards

1 Installation in a trench



Fig. 3 Georolls on the bank of a body of water



Fig. 4 Stacked georolls on the cut embankment of a trench

2 Installation on slopes



Fig. 5 Georolls on a slope

Secumat® Green Coco R 30 is installed and fixed on flat slopes, laterally in trenches or perpendicular to small streams. In trenches, the rolls can be installed perpendicular to the direction of flow or parallel to the direction of flow on the trench slopes, see Fig. 3 Several rolls can be stacked to form a package of rolls, see Fig. 4.

Secumat® Green Coco R 30 must be structurally secured against shifting, floating and wobbling under alternating hydraulic loads by means of stakes and ropes/cables in accordance with the anticipated conditions.

On slopes, the rolls can be arranged parallel to the edge of the slope, see Fig. 5, or at an angle.

Fixing options for Secumat® erosion control mats in different systems

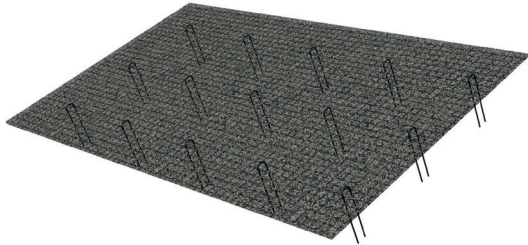


Fig. 1: Naue Erosion Control system



Fig. 2: Levelling of road embankment surface



Fig. 3: Embankment with erosion control system

Surface erosion control

Surface erosion control up to inclinations of 45° (steeper slopes possible) assumes the slope is sufficiently stable. Secumat® erosion control mats decelerate surface run-off until the vegetative layer is fully established. Secumat® erosion control mats, including the top soil layer worked into the structure, are structurally fixed to the existing slope prevent displacement, wind uplift and to ensure intimate contact to the subgrade soil. Fixing materials include 30 cm long wooden pins or U-shaped steel pins with a length of 23 cm and a distance between the pin legs of 4 cm.

When installing erosion control mats, they should overlap in accordance with the recommendation in the Secumat® installation instructions. The distance between fixings is given in the appendix to the Secumat® installation instructions for 3D Mesh products depending on the project boundary conditions.

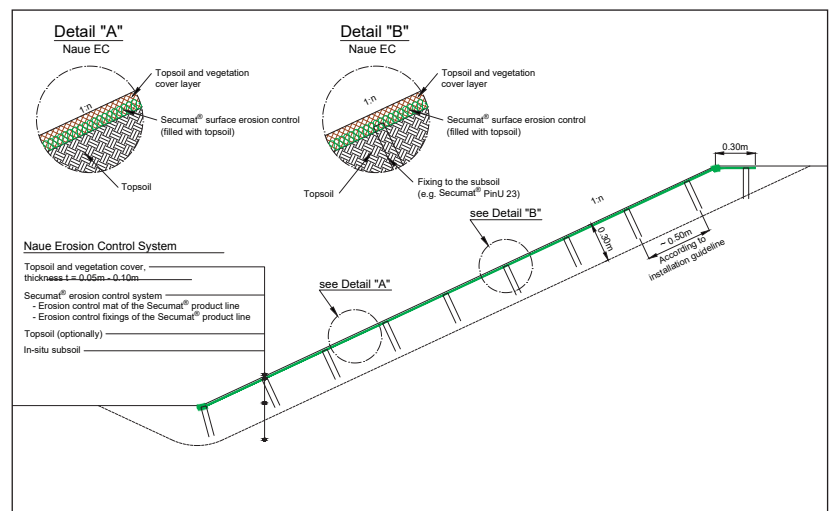


Fig. 4: Technical drawing of Naue Erosion Control system

Naue Erosion Control system (EC)

Type of slope	Measure	System
Stable slope in cut situation, <i>then</i>	support the stability of the surface with an erosion control system and vegetation	Erosion control with Secumat®
Stable slope in fill situation (either by maintaining the standard slope inclination, generally 1:1.5 (V:H), or alternatively $\beta \leq \phi$), <i>then</i>	support the stability of the surface with an erosion control system and vegetation	Erosion control with Secumat®

Tab. 1: Type of slopes and measures

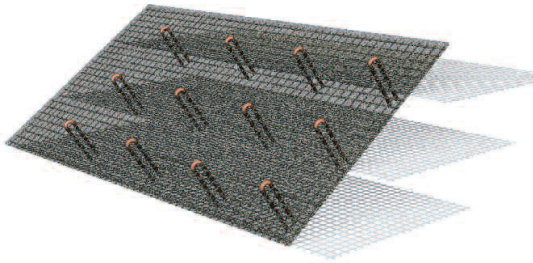


Fig. 1: Naue Clamp system



Fig. 2: Installation of Naue Clamp system



Fig. 3: Initial growth after two weeks

Naue Clamp slope reinforcement

The Naue Clamp system is used in fill situations with slope inclinations up to approx. 50°. Here, a Secugrid® reinforced soil structure is provided with an additional erosion control on the surface of the slope. This consists of a combination of a geogrid and an erosion control system using Secugrid® geogrids and Secumat® erosion control mats which are rolled out down the slope. As the reinforced soil structure does not provide sufficient stability in the facing area (horizontal layers with no wrap), the top layer of soil must be anchored over the erosion control mat down to the compacted backfill soil. We recommend the use of structural fixing materials such as U-shaped pins with an isoscele length of 60 cm and a distance between the brackets of 10 cm or the Secumat® earth anchor system with a minimum length of 50 or 75 cm.

The Clamp system installation instructions must be followed when installing the Naue Clamp system. The distance between fixings is taken from the Clamp installation instructions depending on the project boundary conditions.

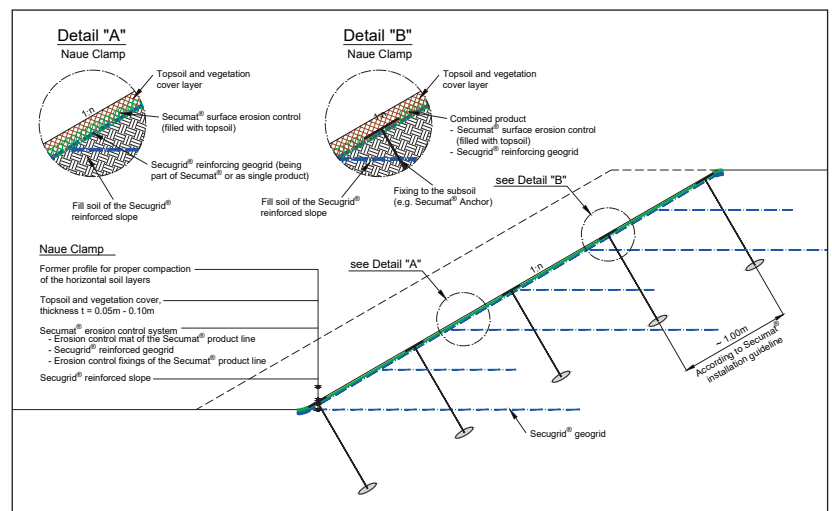


Fig. 4: Technical drawing of Naue Clamp system

Naue Clamp system

Type of slope	Measure	System
Slope not sufficiently stable following fill operations (insufficient safety in accordance with the stability equation ($\beta > \phi$, and in special cases, $\beta > \arctan(\tan(\phi) - 0)/1.25$)), then	the geogrid reinforcement (Secugrid®) must be designed, and the surface secured (Secugrid® + deep penetration fixings) and the stability and vegetation supported by an erosion control system (Secumat®).	Naue Clamp

Tab. 2: Type of slope and measure

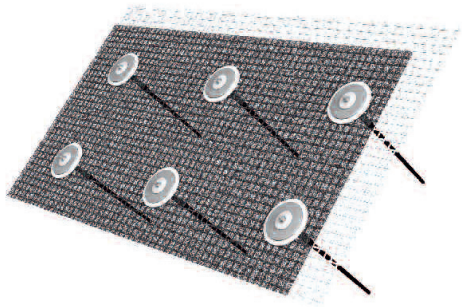


Fig. 1: Naue Nail system



Fig. 2: Installation of Naue Nail system



Fig. 3: Naue Nail system with vegetation cover

Naue Nail steep slope reinforcement

The Naue Nail system is used to control problems with stability or erosion close the surface of existing slopes. The top surface of the slope is covered with a combination of a Secugrid® geogrid and a Secumat® erosion control mat. The system is then tied back into the deeper, stable layers of the existing slope using soil anchors with a head plate.

The required structural distance between soil anchors and the insertion depth is determined based on the project boundary conditions and in accordance with the Naue Nail installation instructions.

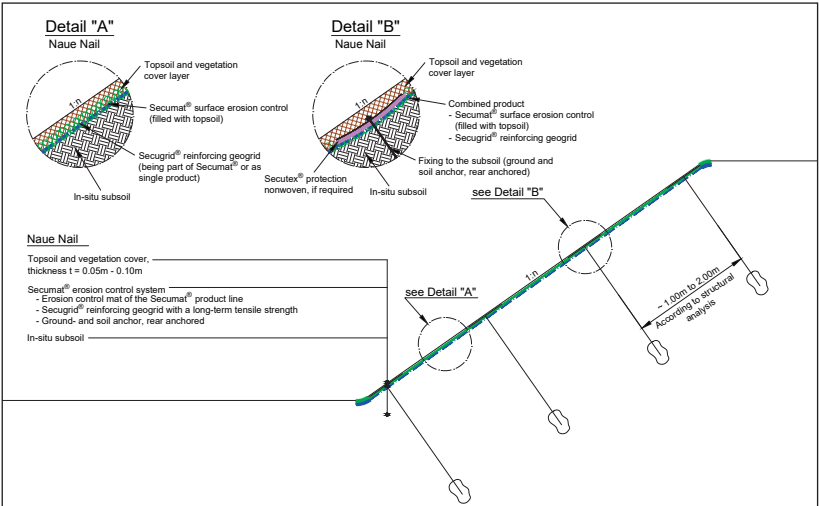


Fig. 4: Technical drawing of Naue Nail system

Naue Nail system

Type of slope	Measure	System
Slope not sufficiently stable due to cut operations, <i>then</i>	anchored reinforcement system, stabilising the slope surface and supporting vegetation through erosion control is required	Naue Nail

Tab. 3: Type of slope and measure