



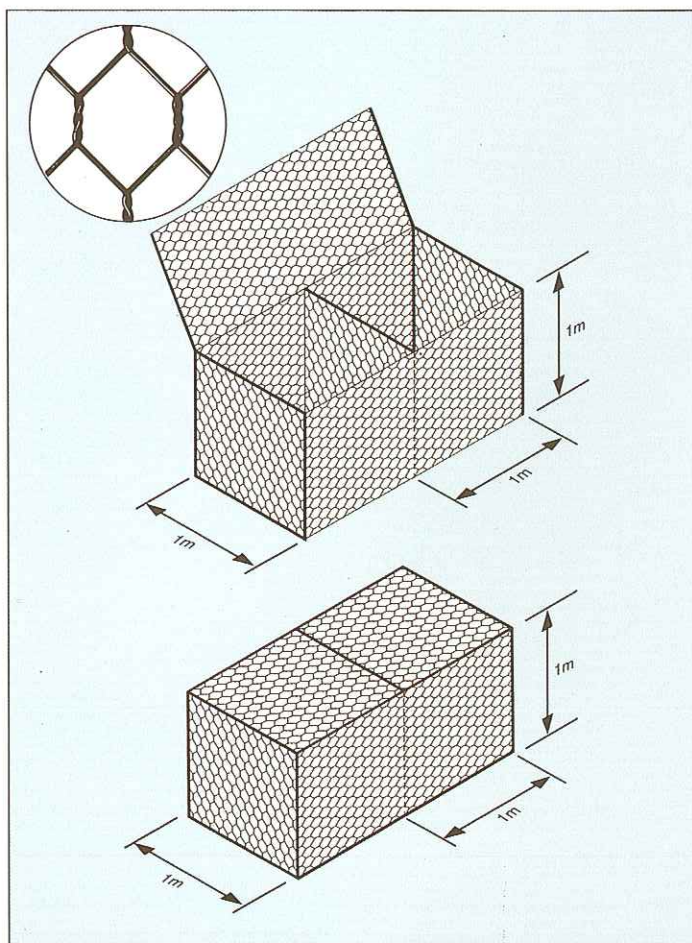
Gabions and Reno Mattresses

General Brochure



Environmental
Solutions

MACCAFERRI



Maccaferri box gabions

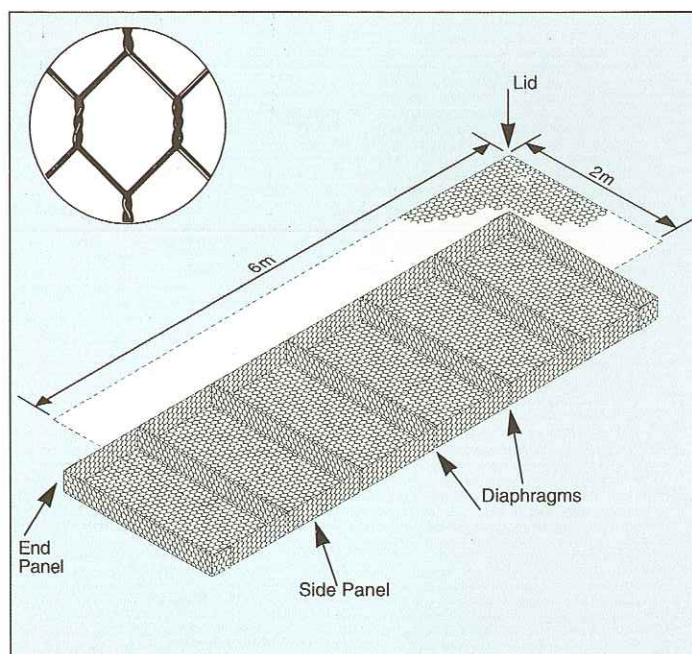
Galvanised box gabions

Box gabions consist of rectangular units, fabricated from a double-twist, hexagonal mesh of soft annealed, heavily galvanised wire. The wire quality and the galvanising meet all international specifications. The mesh panels are reinforced at all edges with wires of a larger diameter than that used for manufacturing the mesh, to strengthen them and to facilitate construction. Gabions are divided into cells by fitting diaphragms which have the function of reinforcing the structure and making assembly and erection easier.

Galvanised box gabions with PVC coating

The characteristics of these products are similar to those of the galvanised gabions; however the wire, prior to manufacturing the mesh, is bonded with a 0.5mm thick special PVC (polyvinyl chloride) continuous coating. A complete protection against possible corrosion is thus obtained making the gabions suitable for use in marine or polluted environments.

Filled with stone, gabions become a large, flexible and permeable building block from which a broad range of structures may be built.



Maccaferri Reno® mattresses

Galvanised Reno® mattress

This is a mattress shaped version of the gabion used mainly for erosion control when the retaining properties of box gabions are not required.

Various thicknesses are available to suit the design requirements.

The base section is divided into 1 metre wide compartments to restrict the movement of stone and strengthen the structure. The lid is supplied as a separate panel.

After assembly on site, mattresses are wired together and filled to form a continuous blanket or lining. The lids are wired to the sides, ends and diaphragms.

Galvanised Reno® mattress with PVC coating

The wire of the Reno® mattress can be coated with PVC in the same manner as that for gabions.

Maccaferri products have been tested in laboratories throughout the world...

Research into the behaviour of gabions and Reno® mattresses has been carried out in both model and full scale tests in France, Holland, Italy, the U.S.A. and United Kingdom.

In 1992 Hydraulics Research, Wallingford was commissioned by the Department of the Environment to investigate the stability of riprap and loose concrete blocks for channel protection in high turbulent flows. A follow-up project for laboratory tests of gabion mattresses and cabled concrete block was later commissioned.

HR Report SR 427 was published in July 1995 when Reno® mattresses were found to be considerably more stable than equivalent riprap, for example: under normal turbulence conditions the required size of the filling stone in a 300mm thick Reno® mattress is approximately half the size of riprap needed under the same flow conditions.

Maccaferri have an ongoing test programme and continue to sponsor research projects.

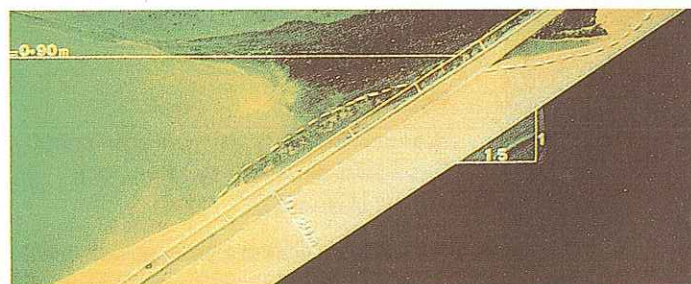
All the above research data and individual design brochures are available from Maccaferri Ltd.



■ Two full size gabion walls under test programme in Italy.



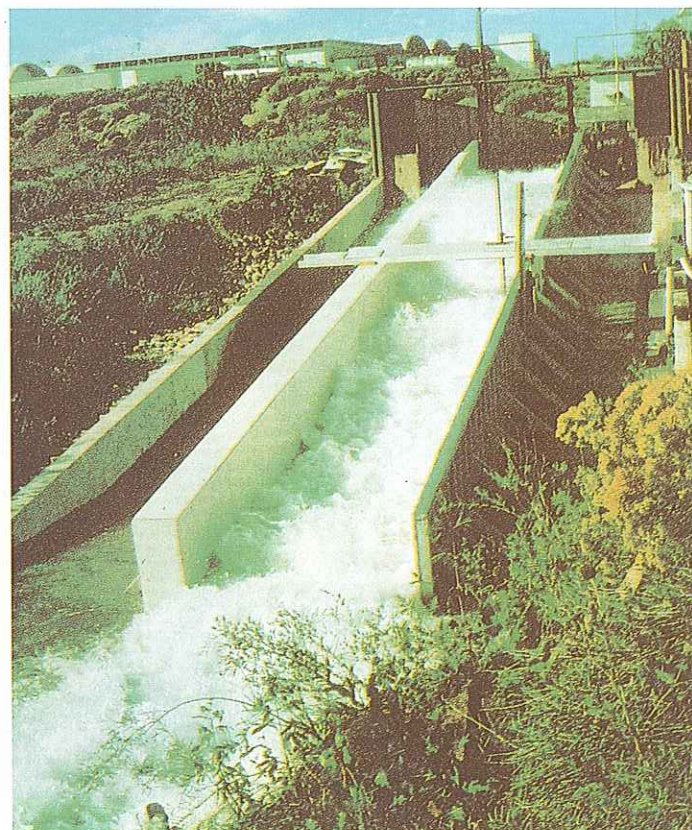
■ Tests to destruction, University of Bologna, Italy.



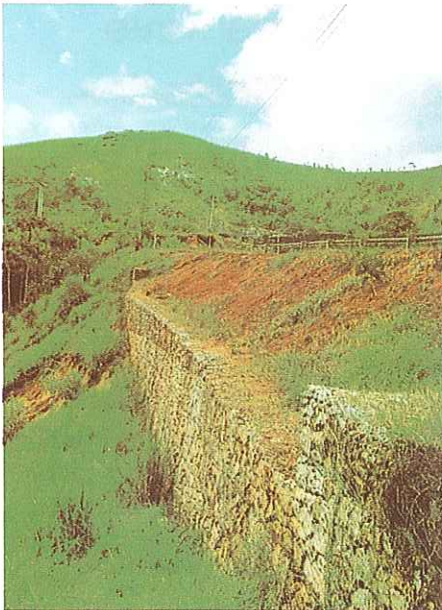
■ Scale model testing in Sogreah, France.



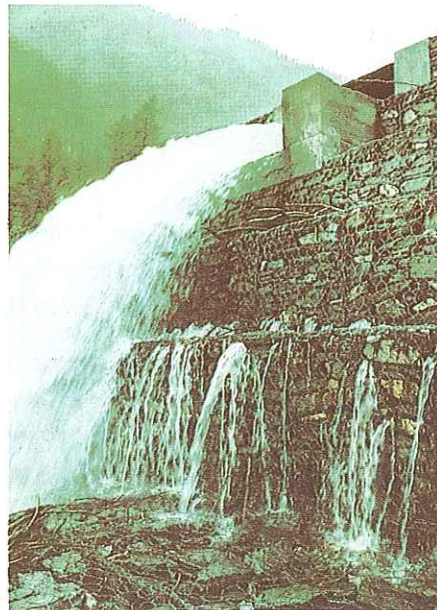
■ Wave action tests, Delft Hydraulic Laboratory, Holland.



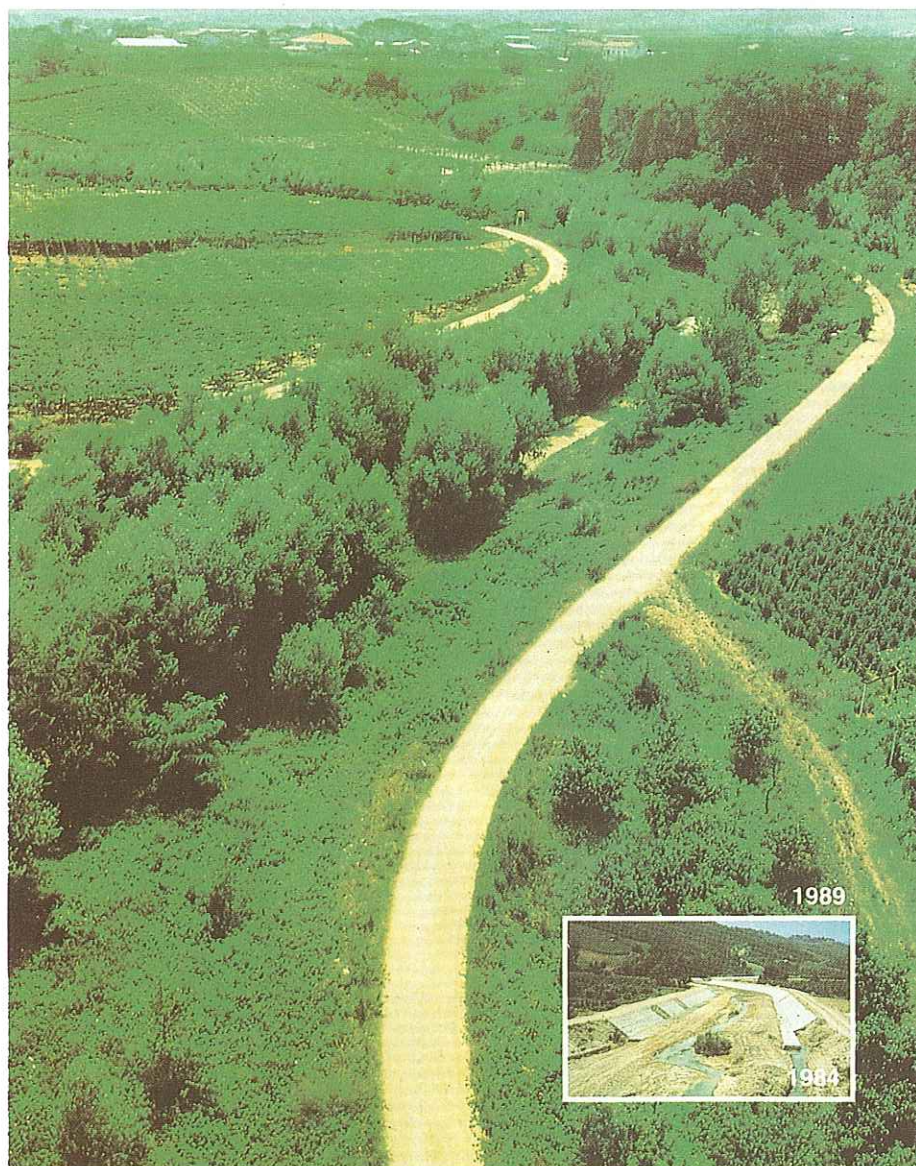
■ Full scale flume testing on Reno® mattresses, Colorado State University.



■ Example of differential settlement without fracture



■ Example of permeable nature



■ ITALY – Abruzzo
Reno® mattress protection with a gabion toe on the River Foro. After only five years vegetation helps restore the ecological balance

Flexibility

An outstanding advantage of the gabion is its flexibility.

Its double-twist hexagonal mesh construction can tolerate differential settlement without fracture. This property is especially important when a structure is on unstable ground or in an area where scour from waves or currents can undermine it.

Strength

The strength and flexibility of the steel wire hexagonal mesh from which gabions and mattresses are made is utilised to withstand and absorb the forces generated by retained earth or flowing water.

Permeability

Hydrostatic heads do not develop behind gabion structures because of their permeable nature.

Their ability to combine drainage and retention functions make them ideal structures for slope stabilisation.

Durability

A Maccaferri gabion or Reno® mattress is a heavy monolithic gravity unit able to withstand earth thrust.

Its efficiency increases instead of decreasing with age since further consolidation takes place as silt and soil collect in the voids and vegetation becomes established.

Economy

Gabion installations are more economical than rigid or semi-rigid structures for a number of reasons.

The following are the most important ones:

- Little maintenance is required.
- Gabion construction is simple, does not require skilled labour.
- Suitable stone fill is available normally on site or from nearby quarries.
- Minimum foundation preparation is required, the surface needs to be only reasonably smooth.
- No costly drainage systems are required, as gabions are permeable.

Ecology

Because gabions permit the growth of vegetation and maintain the existing environment, they provide attractive and natural building blocks for decorative landscaping.



■ ISLE OF MAN

Gabion river wall at National Sports Centre.



■ WALES (Far Left)

Channels and drop structures using Gabions and Reno® mattresses at Mountain Ash, Mid Glamorgan.

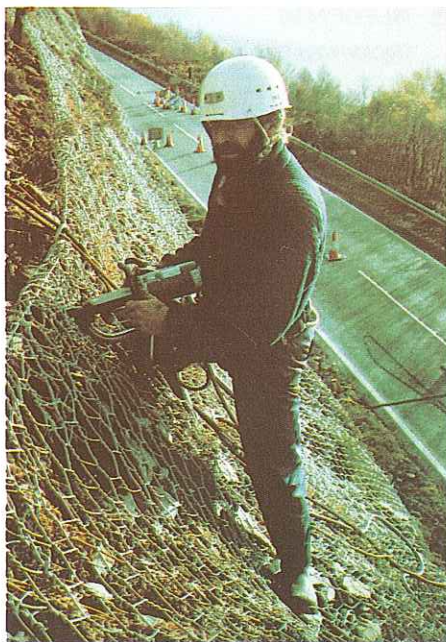
■ ENGLAND (Left)

Gabion retaining wall prior to landscaping, supporting road at Rock Cottage, Lydbrook, Gloucester.



■ ENGLAND

Gabion retaining wall alongside stream at Marsh Mills roundabout, Plymouth, Devon.



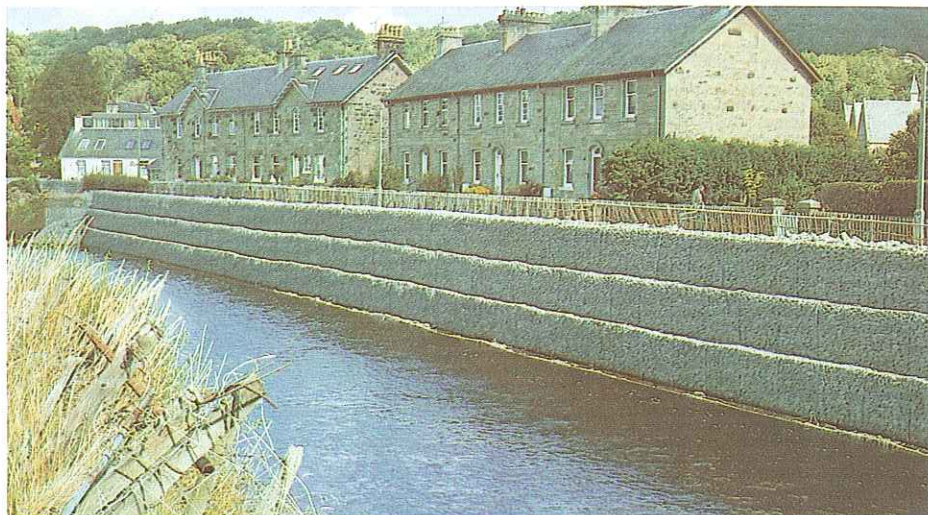
■ SCOTLAND
Rock-netting installation, A835 South Ullapool.



■ SCOTLAND
Gabion retaining wall at Dunkeld House Hotel, Perthshire.



■ ENGLAND
Leicester Road, Ashby de la Zouch



■ SCOTLAND
Gabion wall flood protection at Bridge of Allan.



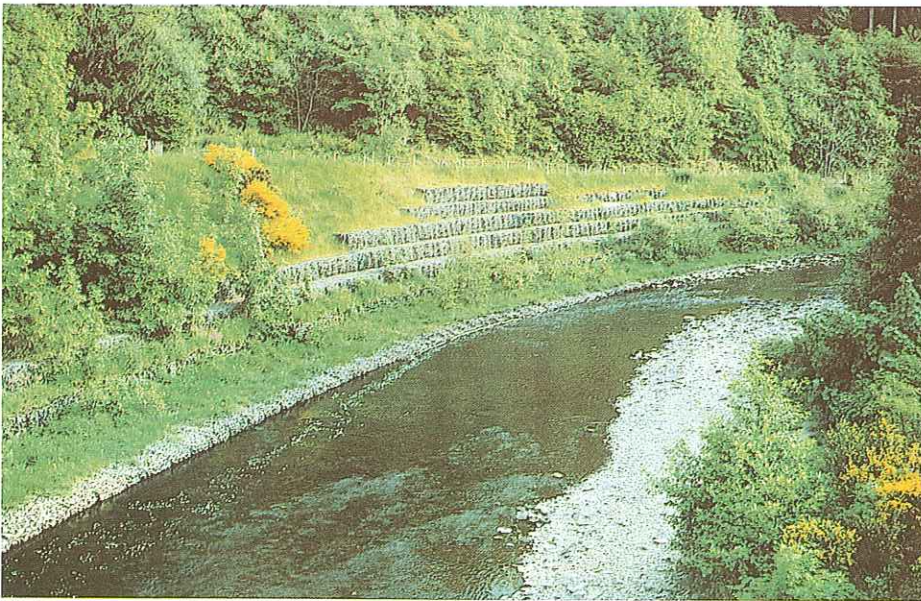
■ ENGLAND
Weir and river walls, River Sheaf, Sheffield.



■ ENGLAND
6m high retaining wall, Thornbury Hospital, Sheffield.



■ SCOTLAND - Dumfries & Galloway
Reno® mattress spillway lining and drop structures, Torbeckhill Reservoir.



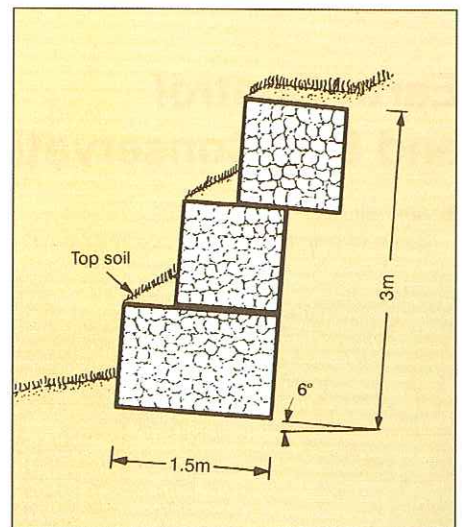
■ SCOTLAND - Tayside
River wall on the River Braan at Dunkeld.



■ ENGLAND - Buckinghamshire
M40 motorway widening between junctions 4 and 5. Approximately 5.5km of gabion walling.



■ SCOTLAND - Highland
Reno® mattress protection at Whin Island on the River Ness.



■ Typical cross-section on M40.

River Training



■ ITALY - Campania
Longitudinal walls on River Lete.



■ MALAWI
Groynes for the protection of the Salima - Benga Road.



■ FORMER YUGOSLAVIA
Weir on the Vranja stream.



■ USA - New York
Gabion bank protection near Buffalo.

Earth Control and Soil Conservation

■ REPUBLIC OF CAPE VERDE
Series of structures for soil conservation on Santiago Island.



■ ITALY - Tuscany
Drainage channel to stabilise a slope near Florence.

Retaining Structures



■ SWITZERLAND
Retaining wall for the protection of the railway near Alpnach.



■ GERMANY
Retaining wall along a road near Obnerwesel.

Bridge and Culvert Protection



■ BRAZIL - S.Paulo
Bridge abutments on Turvo river, near S. José dos Campos.



■ CANADA - Ontario
Culvert protection near Cornwall.

Marinas and Seashore Protection

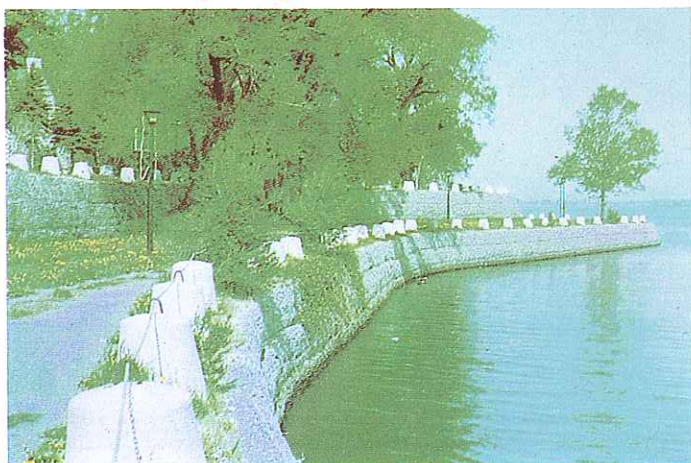
■ BRAZIL - Paraná
Protection of the Praia Mansa at Caiobã.



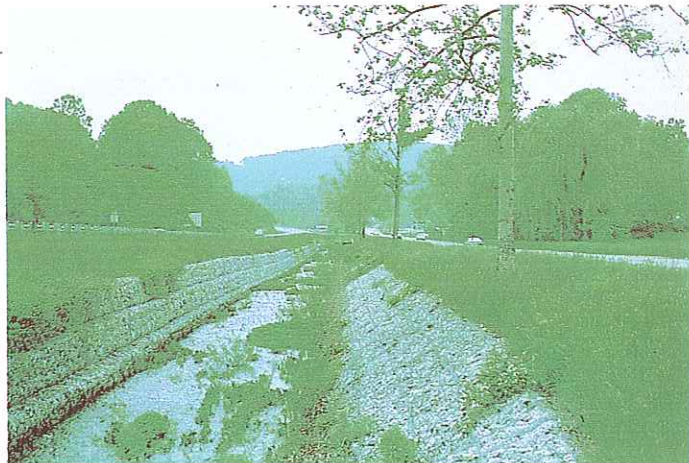
■ CANADA - Quebec
Marina walls at Matane; the work was carried out using PVC coated gabions.



Landscaping



■ CANADA - Quebec
River wall to a city park along the St. Lawrence in Candiac.



■ USA - Maryland
Lining of a stream near Frederick, along highway A40.

Impermeable Lining of Dams



■ ITALY - Sardegna
Lochele dam (Nuoro) Reno® mattresses can be sealed by hot poured sand asphalt mastic, in order to provide an impermeable revetment.

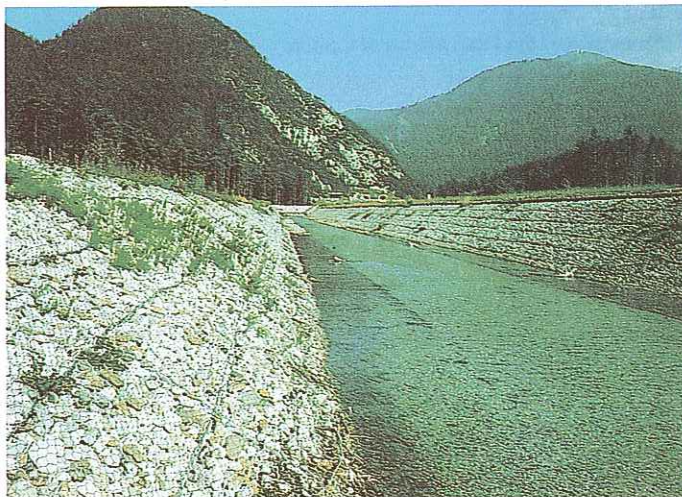
Protection of Road and Railway Embankments



■ ITALY - Calabria
Reno® mattress lining carried out along the railway line Salerno-Reggio Calabria near Amantea (CS).

Channel Lining

■ ITALY
Canalisation and lining of the Fella stream (Udine).

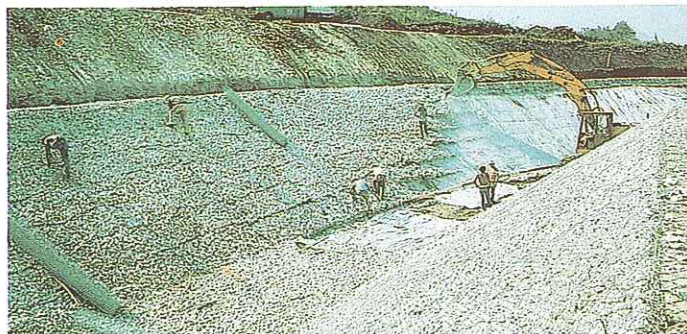




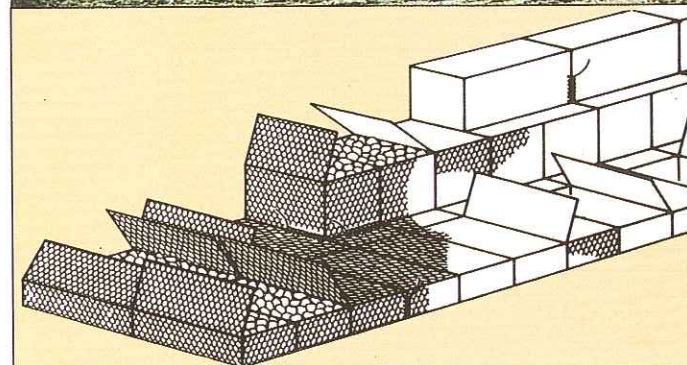
■ Bundles of gabions ready for shipment.



■ Gabion filling operation.



■ Reno® mattresses filling and closing operation.



■ Assembly of a gabion structure

Gabions and Reno® Mattresses

Assembly

Gabions and mattresses are shipped folded and packed together in bundles, in order to occupy less space and make transportation to sites economical and easy.

On site, they are opened and assembled as follows: corners are wired together and diaphragms are fixed to the side panels. Empty units are subsequently joined together along all adjacent edges, both horizontally and vertically.

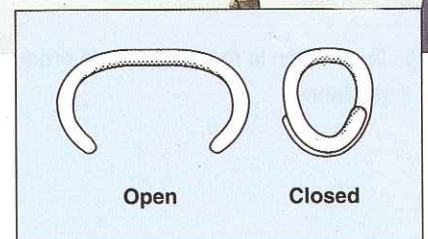
Filling

This is usually carried out by mechanical means using rounded river shingle or quarry stone having a size slightly larger than that of the mesh, so as to have minimum percentage of voids. The use of hard material of high specific gravity is recommended.

Pneumatic Assembly Tool

The magazine of this new tool holds up to 80 galvanised or stainless steel "C" rings for rapid assembly.

The system ensures a strong joint of consistent high standard reducing labour cost by increased production.



Notes for Guidance

Gabions can be supplied in a variety of different specifications to meet durability, performance and economy requirements of the specifier.

Individual specification should always include the following basic points:

- **The mesh type** – example: *flexible hexagonal woven wire mesh of 80mm opening size.*
- **The mesh wire** – The British Standard for the steel wire with diameter of the mesh wire and if PVC coated, the overall diameter including the PVC – example: *steel wire to BS 1052, 2.7mm diameter galvanised mesh wire PVC coated to 3.7mm overall diameter.*
- **Details of the reinforced selvages** – example: *all mesh edges shall be reinforced with a galvanised PVC coated selvedge wire of 3.4mm core diameter overall 4.4mm diameter.*
- **Protective coating** – The British Standard for the galvanising and protective coating of the mesh wire - example: *mesh wire to be galvanised to BS 443 OR wire to be galvanised to BS 443 with a bonded grey PVC coating of mean wall thickness of 0.5mm.*
- **Certification** – example: *BBA certification requirement for durability and Technical Approval.*

SPECIFICATION EXAMPLES

PVC COATED GABIONS

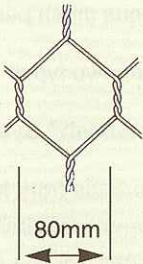
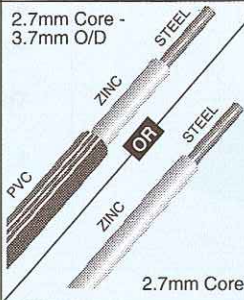
The gabion shall be 2x1x1m with fixed diaphragms at 1.0m centres. The gabion shall be manufactured from steel wire to BS 1052 of 2.7mm diameter and galvanised to BS 443 with a bonded grey PVC coating of mean wall thickness of 0.5mm to give overall diameter 3.7mm. The mesh fabric shall be formed from flexible double twist hexagonal woven wire mesh of 80mm opening size. All mesh edges shall be reinforced with a galvanised PVC coated selvedge wire of 3.4mm core diameter, overall 4.4mm diameter. All joints and connections of gabion units are to be formed using continuous lacing wires and/or high tensile stainless steel "C" rings from 3.0mm wire, attached with a pneumatic assembly tool. PVC coated lacing wire shall be 2.2mm core diameter and be to the same specification as the body mesh.

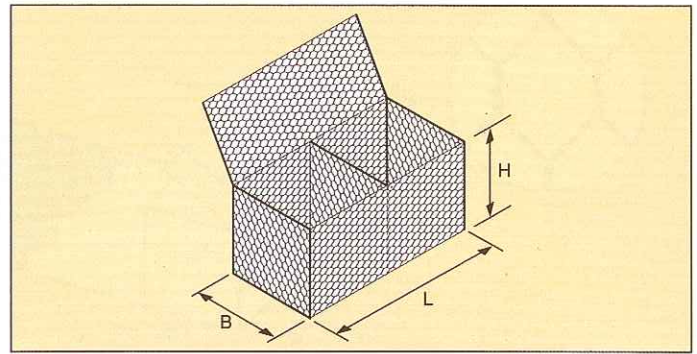
BBA Certification is required for the product for up to 120 year life expectancy.

GALVANISED RENO® MATTRESSES

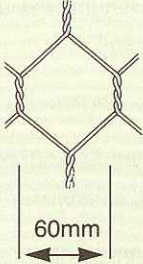
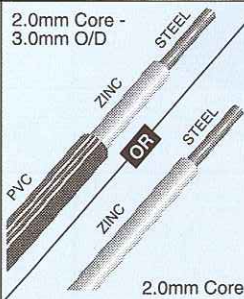
The mattress shall be 6x2x0.23m with fixed diaphragms at 1.0m centres. The mattress shall be manufactured from steel wire to BS 1052 of 2.0mm diameter and galvanised to BS 443. The mesh fabric shall be formed from flexible double twist hexagonal woven wire mesh of 60mm opening size. All mesh edges shall be reinforced with a selvedge wire of 2.4mm diameter. All joints and connections of mattress units are to be formed using continuous lacing wires and/or high tensile steel "C" rings attached with a pneumatic assembly tool. The 2.2mm diameter lacing wire and 3.0mm diameter "C" rings are to be zinc coated to the same specification as the body mesh. BBA Certification is required for the product.

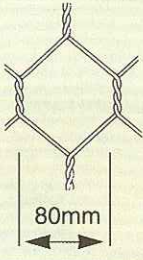
MACCAFERRI GABIONS

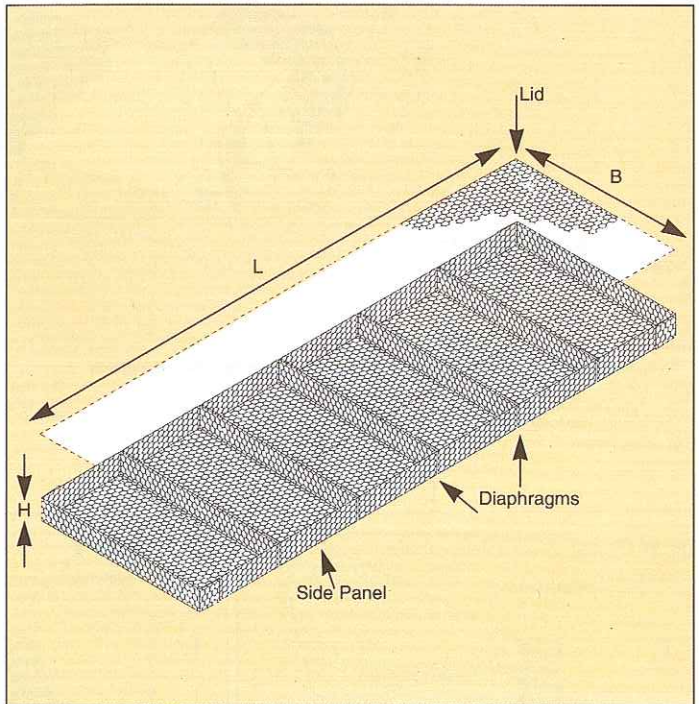
LxBxH	Nominal Mesh Size	Mesh Wire Diameter
1 x 1 x 1		2.7mm Core - 3.7mm O/D
2 x 1 x 1		
4 x 1 x 1		
1.5 x 1 x 1		
2 x 1 x 0.5		
4 x 1 x 0.5		
2 x 0.5 x 0.5		
6 x 2 x 0.5		



RENO® MATTRESS

LxBxH	Nominal Mesh Size	Mesh Wire Diameter
6 x 2 x 0.17		2.0mm Core - 3.0mm O/D
6 x 2 x 0.23		
3 x 2 x 0.17		
3 x 2 x 0.23		

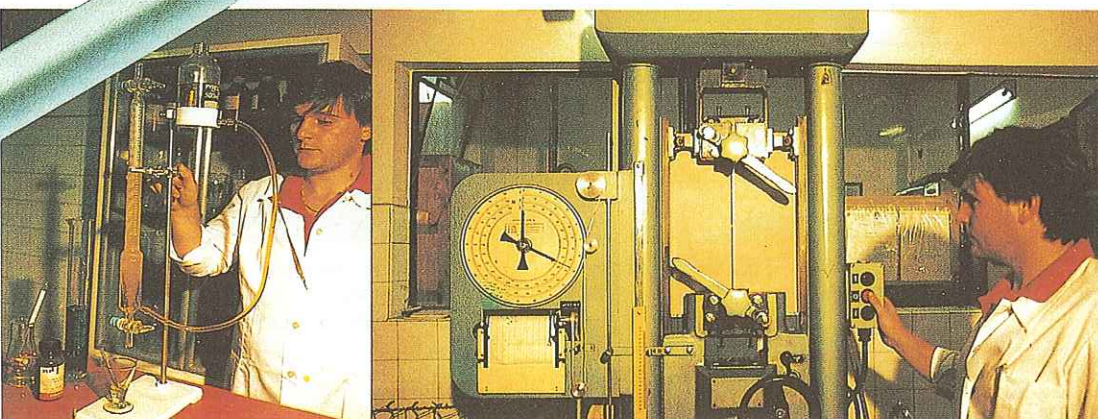
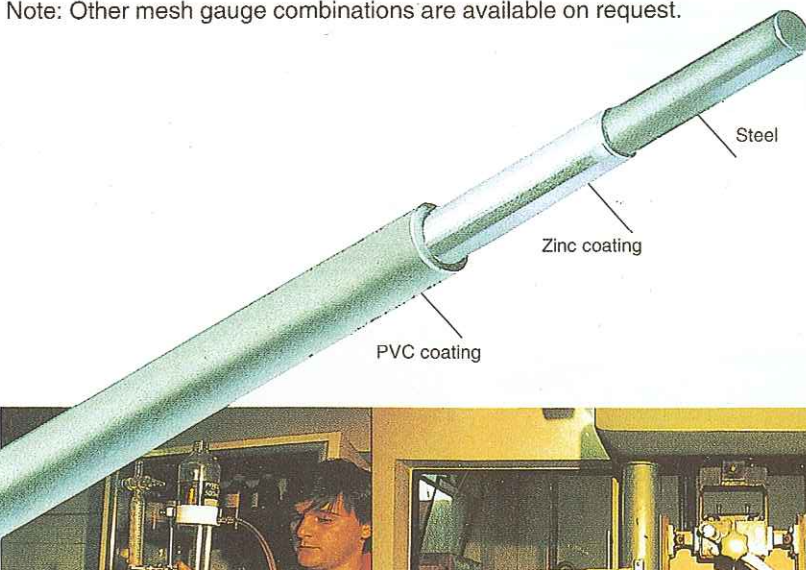
LxBxH	Nominal Mesh Size	Mesh Wire Diameter
6 x 2 x 0.3		2.0mm or 2.4mm Core - 3.0mm or 3.4mm O/D
3 x 2 x 0.3		2.0mm or 2.4mm Core



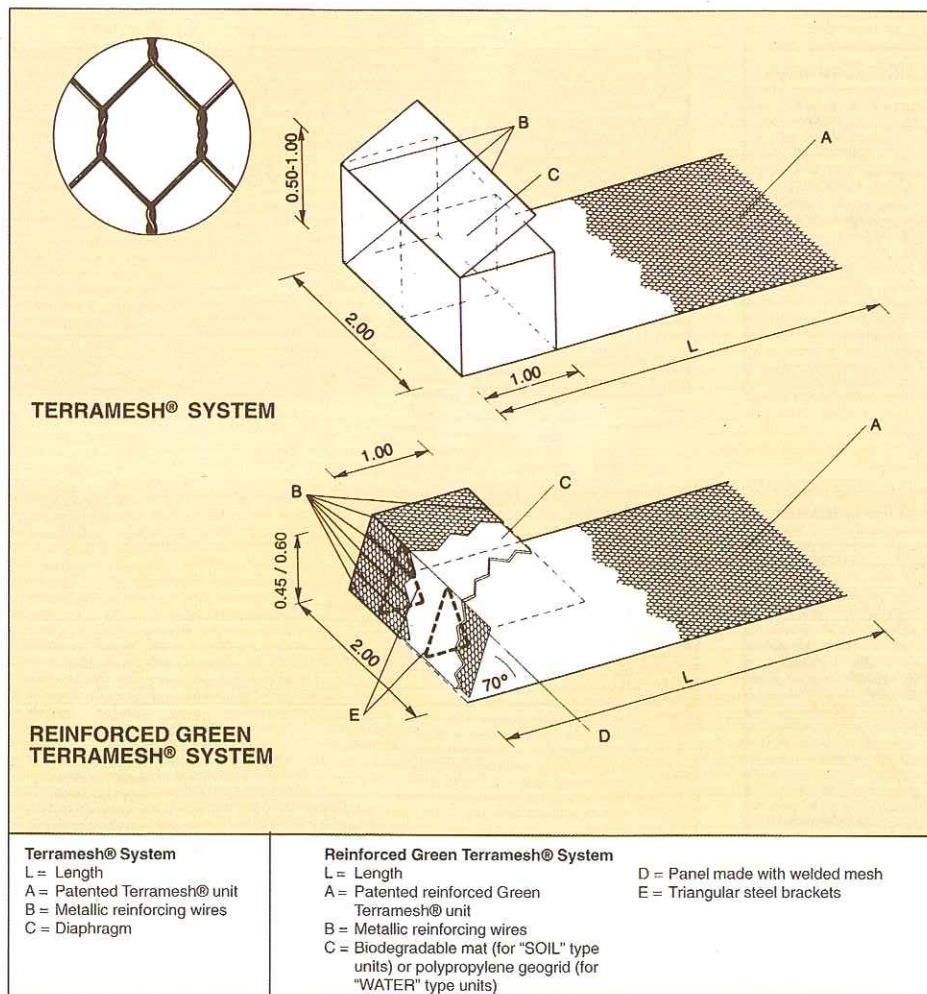
Note: Other mesh gauge combinations are available on request.

Quality Standards

- Maccaferri products meet the following standards:
 - All manufactured under ISO 9002.
 - BS 8002 for gabions in all aspects.
 - Specification for Highway Works.
- BBA Certification for up to 120 years life expectancy.



■ One of our laboratories where wire quality control tests are carried out.



This is a reinforced soil system where units forming the front face and anchorage element are made from one continuous mesh panel.

There are two types:

1. Terramesh® System

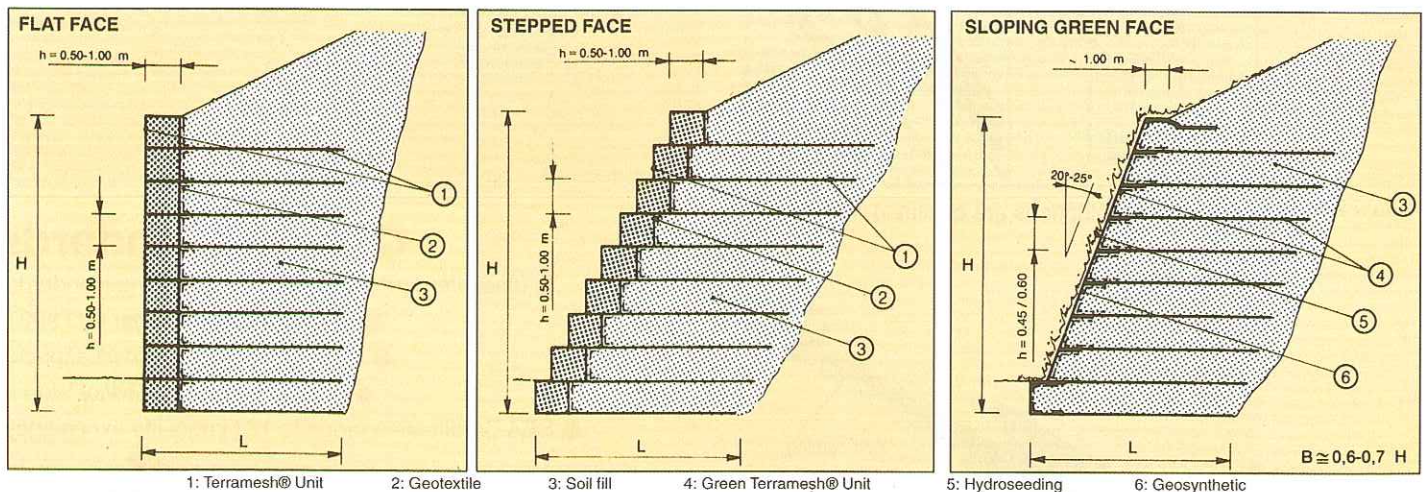
Where the front face is either flat or stepped and similar to stone filled box gabions 0.5 or 1.0 metre high.

2. Reinforced Green Terramesh®

Where the maximum face angle of 70° is fixed by a triangular reinforcing steel bracket and the unit is entirely filled with soil.

The exposed face is lined with:

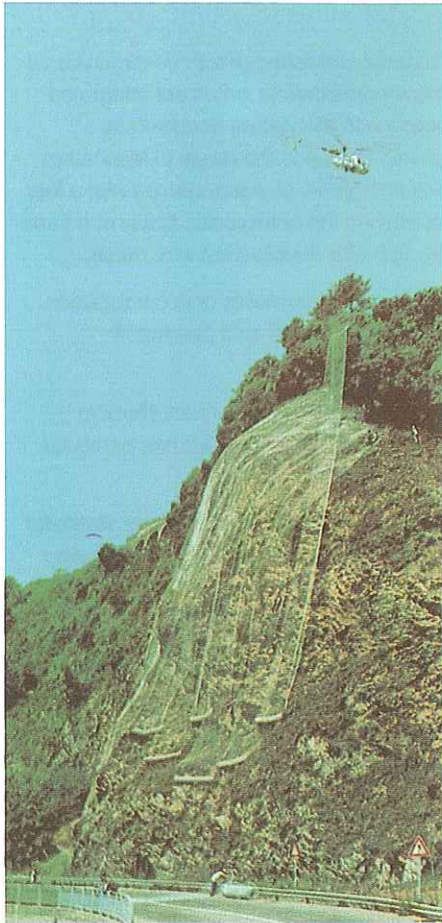
- a biodegradable mat for "soil" type units suitable for hydroseeding.
- a three-dimensional geogrid on "water types". The "water" type can be used for bank protection of water courses.



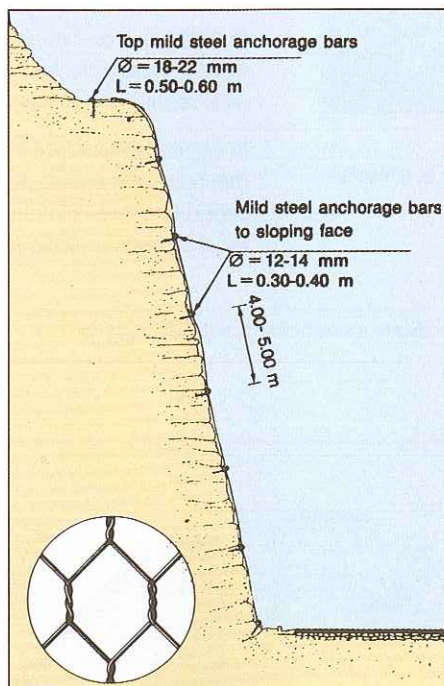
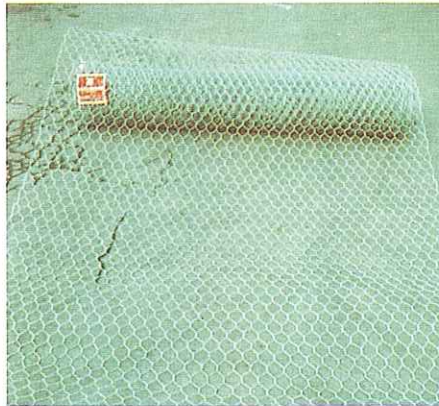
■ AUSTRALIA - Homebush, Sydney
Site of the Olympic Games in 2000



■ ITALY - Sardegna
Retaining works carried out with Green Terramesh® units along the road Bitti-Lula which connects the SS131 to the SS389.



■ ITALY - Liguria
Erection of netting by means of a helicopter, near Arenzano.



Wire mesh netting is often used to prevent rocks and debris from falling on to roads and railways.

This solution can also help to establish vegetation.

Maccaferri rockfall mesh has the same characteristics as that used for gabions and Reno® mattresses.

Thanks to the double-twist weaving, it is strong enough to withstand the force of the falling rocks and, unlike chain-link mesh, does not unravel should some of the wires break.

■ ITALY - Valle D'Aosta
Erection of netting carried out manually.



■ USA - Tennessee
Erection of netting by means of a crane, along Interstate 40.



■ ITALY
Lacing the netting.



■ Italy - Trentino-Alto Adige
Protection with MacMat-R® of slope overlooking a railway in
Brunico-Bolzano, near Perca (BZ).

MACMAT - R®

MacMat-R® is a composite material consisting of a three dimensional geomat made of polypropylene monofilaments which are integrated during the manufacturing process with Maccaferri double-twist hexagonal mesh. This new product extends the range of Maccaferri products used to protect slopes and banks of watercourses with a low erosive action. MacMat-R® combines the anti-erosive ability of a three-dimensional geomat to the strength of a double-twist wire mesh.

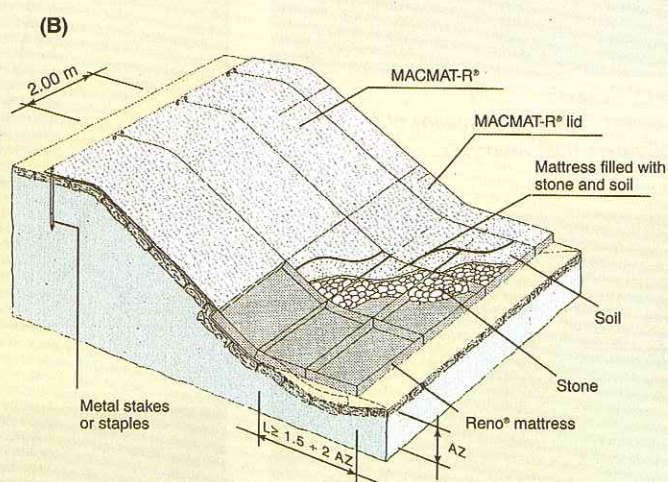
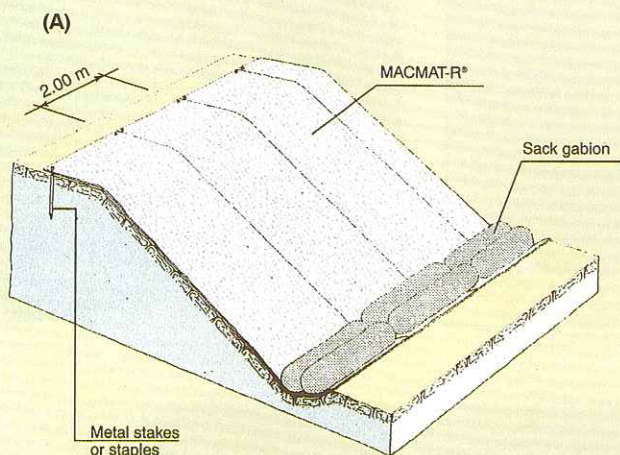
It may be used on its own for light duty revetments or in combination with other Maccaferri products such as Reno® and Geomac® mattresses.

MacMat-R® thanks to its synthetic component, offers an effective solution to the problem of grassing steep slopes which has particular applications in the capping of landfill sites.

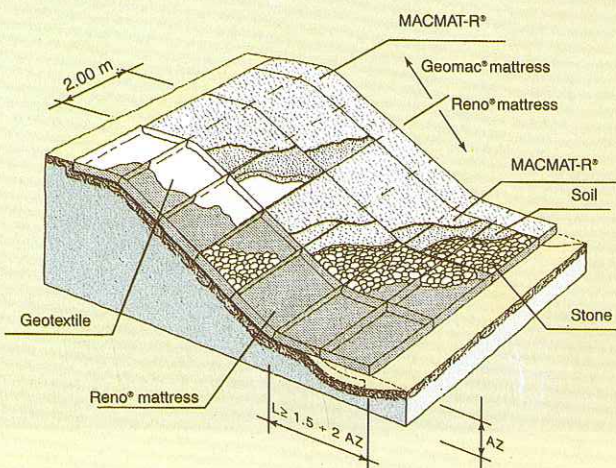
In addition to re-establishing vegetation MacMat-R® is also suitable for rockfall protection where there is a need to prevent rocks from falling onto roads and railways.

In this case MacMat-R® combines the containment effect of the metal mesh and the enhancement of the vegetation growth through the supporting three dimensional matting. The density of the matting allows for easy hydromulching and accelerating a successful vegetation growth.

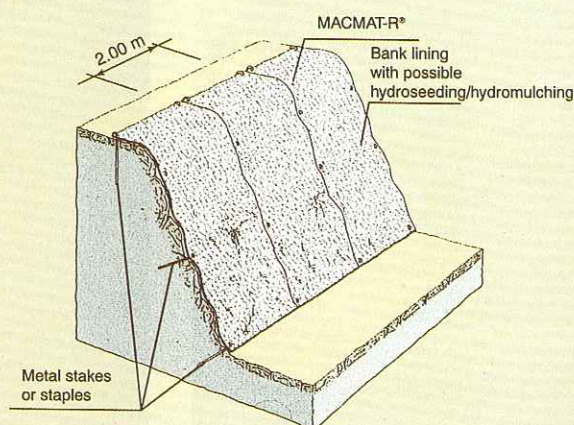
Slope stabilization with MacMat-R® and different toe protection: (A) with sack gabions; (B) with Reno® mattress



Slope protection with MacMat-R® combined with Reno® mattress



Protection of very steep slopes.





Maccaferri Gabions are strong enough to be pre-filled and lifted by crane.

Additional lacing wire is required to double tie the units during assembly and 20mm reinforcing bars may be incorporated along the top edges to help maintain shape during lifting.

Purpose made lifting frames have proved to be the best method for lifting the filled units and these can either be fabricated or hired from Maccaferri Ltd.

Maccaferri Reno® mattresses can be pre-filled and lifted in a similar way using special lifting frames to suit 3m x 2m and 6m x 2m units.

A geotextile can easily be wired to the underside of the mattress.

For placing large areas of mattress, more sophisticated methods are available using purpose built pontoons etc.

Maccaferri Ltd will be pleased to give detailed examples.



1995

1894

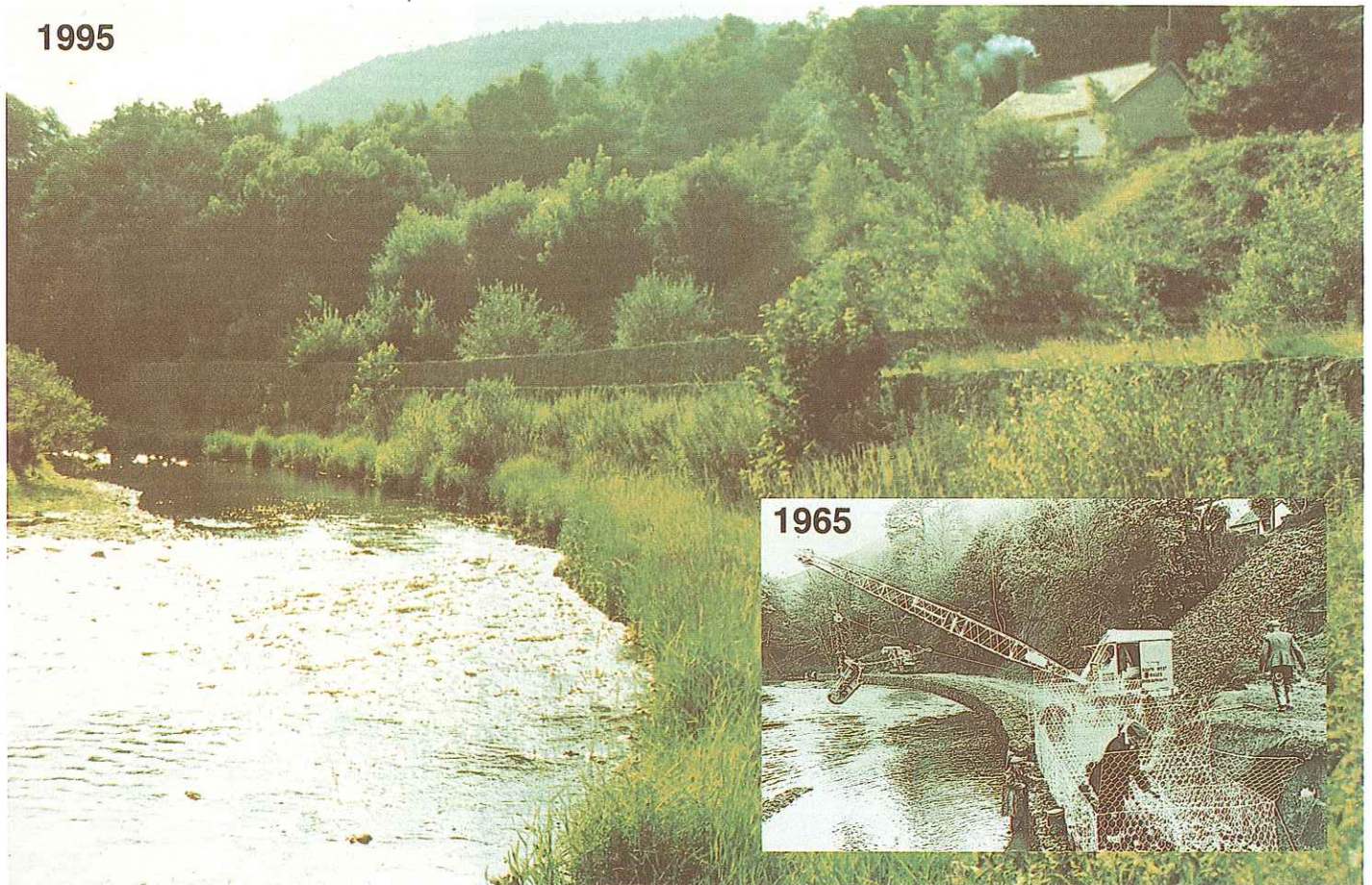


■ 1894 - 1995 Caselicchio di Reno, Northern Italy

■ 1965 - 1995 River Cothy, Abergorlech.

1995

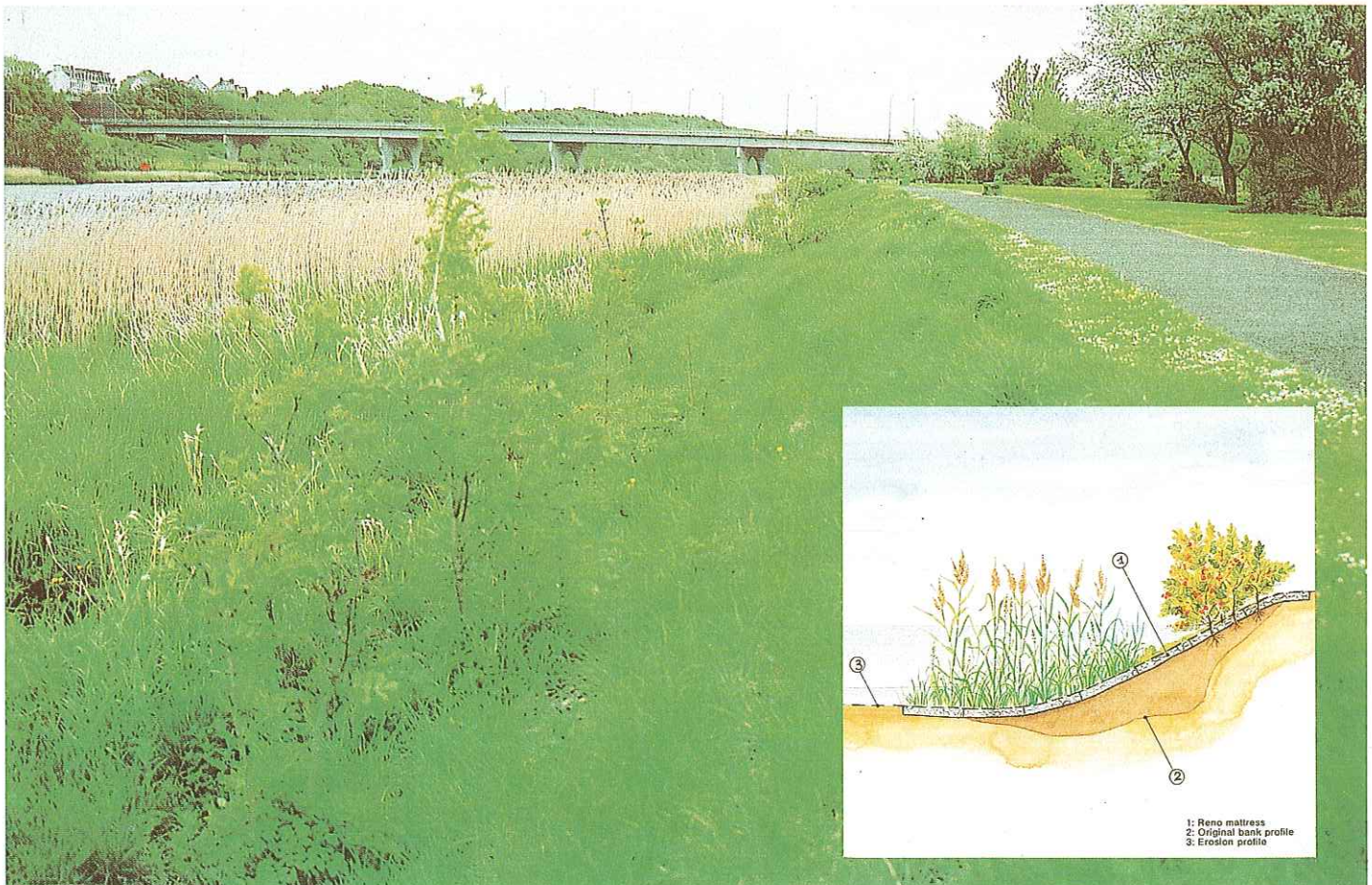
1965

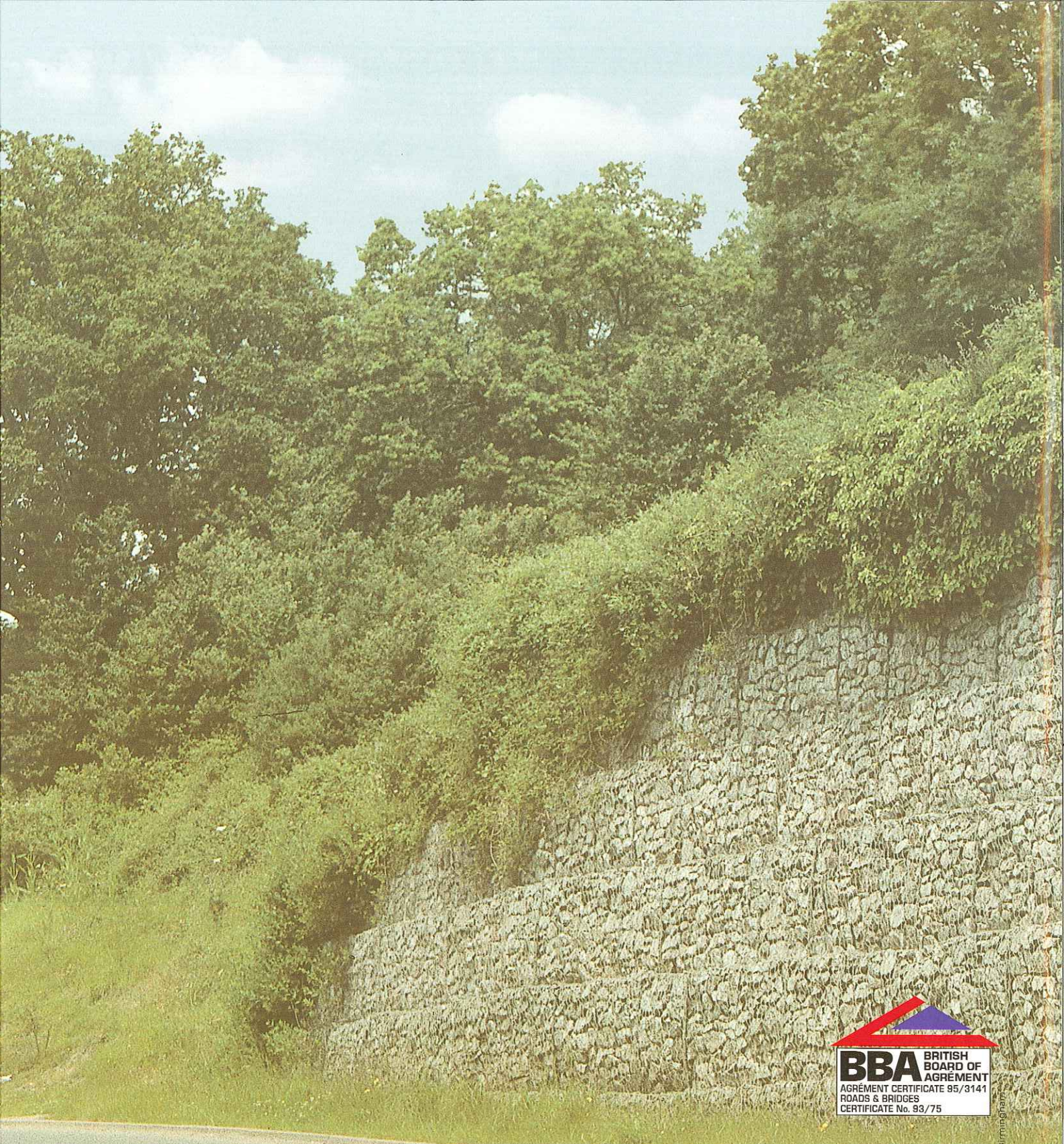




■ SCOTLAND - Mill Brae Bridge, Langside, Glasgow

■ NORTHERN IRELAND - River Bann





**Environmental
Solutions**

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