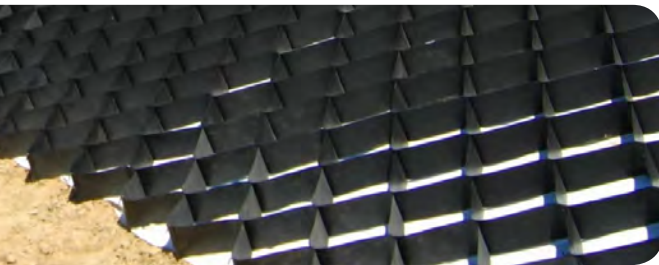




Creating Green Infrastructure

InfraWeb



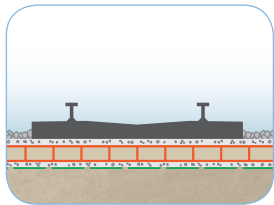
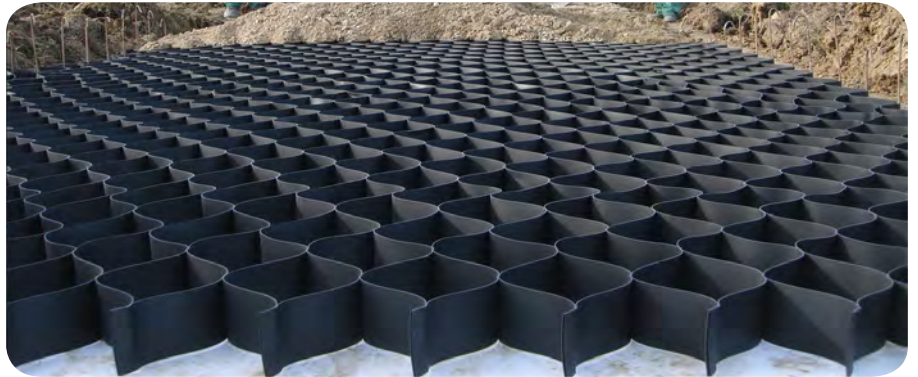
InfraWeb cellular confinement systems

InfraWeb

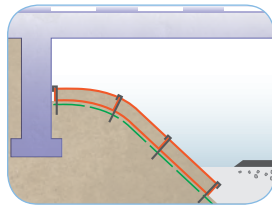
Cellular Confinement

InfraWeb is a lightweight, expandable cellular confinement system which creates an erosion barrier or structural foundation.

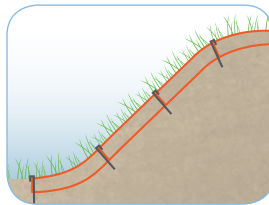
- Erosion Control
- Ground Stabilisation
- Retaining Walls
- Tree Root Protection



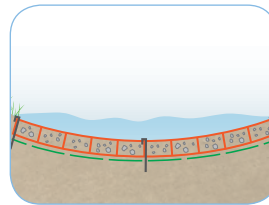
**Access Roads /
Railway Ballast**



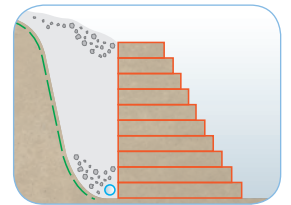
Embankment



Slope Protection



**Stream / Channel
Protection**



Retaining Walls

InfraWeb is guaranteed to be durable for a minimum of 50 years in natural soils with $4 < \text{pH} < 9$ and soil temperatures of up to 25 deg C.

Background

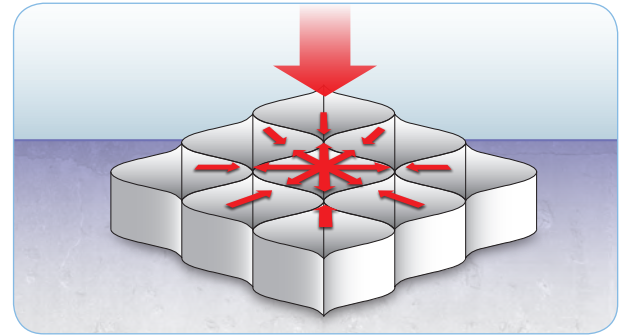
Cellular Confinement Systems were first developed by the US Army in the 1970's in order to construct roads, airstrips, etc. on soft soil and under wet weather conditions. It was determined that placement of thin walled, sand filled cells over a soft subgrade provided significantly greater load bearing capability than compacted soil alone.

High density polyethylene (HDPE) was found to provide an optimal solution in terms of strength, durability, ease of handling and economics.

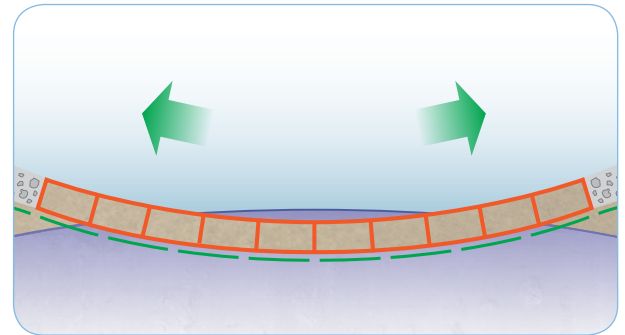
Cellular confinement systems have since been used extensively in a variety of applications such as road building, ground stabilisation, erosion control, landscaping etc.

The InfraWeb confinement system can be used with a variety of infill materials – soil, aggregates, concrete etc. - depending on the application.

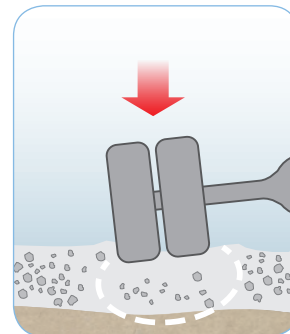
For instance, because it restricts the movement of the fill material whilst allowing free movement of water and nutrients in a vegetated environment, it can be used in landscaping applications for slope protection.



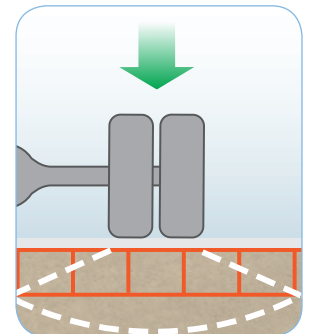
Force/Load distribution



Load distribution



Without InfraWeb



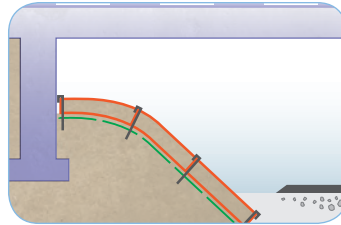
With InfraWeb

Erosion Control

Erosion occurs when the forces exerted by water or wind dislodge and transport away soil particles.

Embankments

While seeding and vegetation provide a cost effective solution on gentle slopes, the InfraWeb cellular confinement system provides an economical solution for severe erosion conditions when compared to a combination of geotextile and stone layers, gabions and the like.



The cells of the InfraWeb system can be filled with soil, sand, aggregate, concrete etc. The infill is protected by the cell thus preventing its removal by erosion forces. Each cell functions as a small dam allowing water or wind to pass over the top without removal of the infill. If seeded soil is used as the filling material, mowing can be carried out without any interference from the cell walls. If concrete is used, the system will protect the underlying soil from either wind or water erosion.

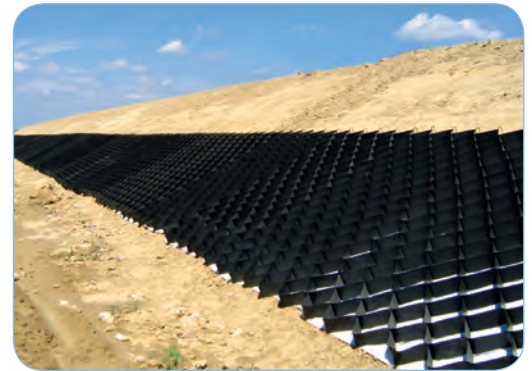
The amount of erosion depends on the following factors:

Design Consideration

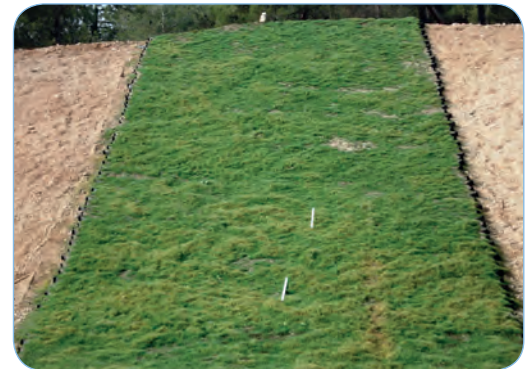
- Strength of wind/water
- Dimensions of the slope (height, length and steepness)
- Type of soil



Embankments / Slope Protection



Embankments / Slope Protection



Embankments / Slope Protection

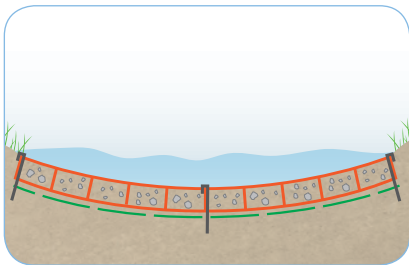
Channel & Stream Protection

InfraWeb can be used to prevent erosion of channels and stream beds. The units are laid on both embankments as well as the bottom of the channel/stream.

Infilling can be either with local material or concrete. This should be determined by the maximum flow rate of the water.

Where strong currents are to be expected, concrete should be used to prevent erosion.

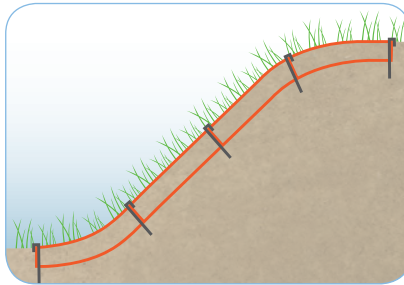
The utilisation of cellular confinement allows for reduced quantities of concrete, especially in the case of steep embankments, due to the fact that the concrete is contained in the cells and down pouring at the embankment will not occur.



Slope Protection

When external weight is required for slope stability, filled InfraWeb will provide it.

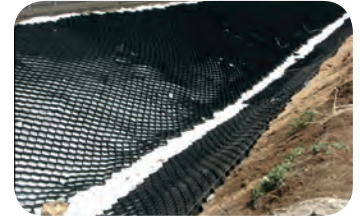
For example, InfraWeb when applied to stream beds and road embankments will prevent deterioration by water erosion.



Water Reservoirs

InfraWeb can be used as a load supporter on the bottom and sides of water/sewage reservoirs. In this manner savings in the construction can be achieved.

Furthermore, geomembranes of lower thickness may be used to seal the reservoir, contributing to even more savings without compromising the quality of the project.



Channel & Stream Protection



Channel & Stream Protection



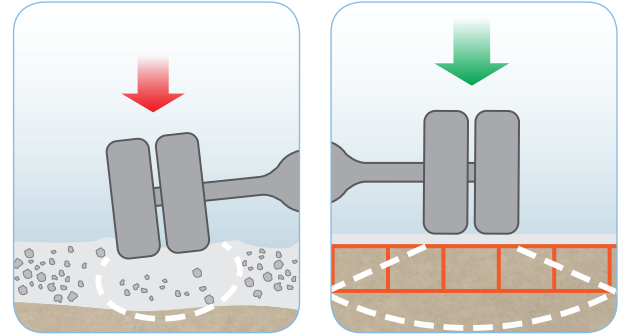
Water Reservoir



Water Reservoir

Ground Stabilisation

InfraWeb cellular confinement systems serve to spread loads that are imposed upon the system. Furthermore, in many instances it is possible to use locally available, inexpensive aggregates in a multitude of stabilisation projects such as: Roads, Access lanes, Runways, Car Parks, Railway track bedding, Bedding for sewer and water pipes.



Access Roads



Access Roads

Generally, in stabilisation end-use, the aggregate layer spreads the load imposed upon it, thus reducing the pressure exerted on the subgrade below a critical value. The InfraWeb system provides confinement throughout the depth of the aggregate, not just at the interface between the aggregate and the subgrade. The load spreading characteristics of the aggregate is now enhanced due to the confinement of the aggregate. Therefore it is possible to use lower quality aggregate and/or reduced quantity thus lowering costs.

Access Roads

Dirt tracks, woodland roads, quarry roads, temporary access roads etc., can be easily and in-expensively constructed with InfraWeb. The load bearing and load distribution characteristics of cellular confinement systems allow for such roads to be constructed with minimal preparation (often just levelling). Considerable savings can be achieved by infilling with local soil, so that hauling of expensive infill material is avoided. For instance, 100mm cells filled with sand are equivalent to at least 300mm of sandy gravel or 250mm of crushed stone. Furthermore, stresses on the soft subgrade beneath the cellular reinforced soil are reduced by >30% and deflections have been found to be 15% lower when compared to unreinforced layers.

It has been shown (Koerner, Designing with Geosynthetics, 4th edition) that the bearing capacity of sandy soil is increased thirteen fold when a 200mm geocell is used and infilled with the same material. The mechanism is explained by the fact that the higher cell wall / infill interface friction increases the resistance to vertical deformation of the infill material relative to the cellular structure. With an increased densification of the infill material, the improvement in bearing capacity can be exponential. Additionally, maintenance costs are reduced to a minimum thanks to the fact that rutting is eliminated. If required, InfraWeb can be removed from the site once the road becomes redundant and the site can be returned to its original condition. In this context, it should be noted that reconstruction of asphalt surfaced roads with cellular confinement systems can reduce the stresses on the subgrade by approximately 30% thus helping to ensure the longevity of the road.



Verge Reinforcement

The InfraWeb cellular confinement can also be used to reinforce roadside verges and provides a cost effective solution for the prevention of rutting and material wash out.

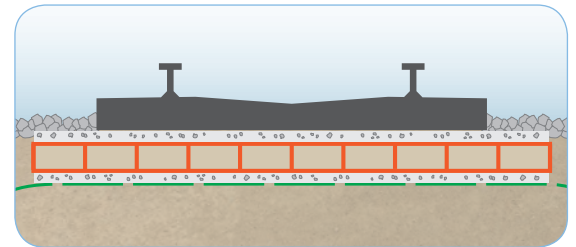
Railways

Unstable railway embankments and track settlement cause considerable problems and difficulties in track maintenance, and have significant cost and time implications. Such factors can lead to decreased train speed and in extreme cases to the shutting down of track sections.

Over the last 20 years considerable work has been undertaken, using confinement systems over compressible soils to provide full stability and resistance to static and dynamic loads.

This solution, when compared to more traditional methods, offers decreased maintenance time and cost, whilst maintaining track strength parameters for longer periods of time.

Cellular confinement systems have been used not only for the construction of new tracks, but also to repair subballast and railway embankments.



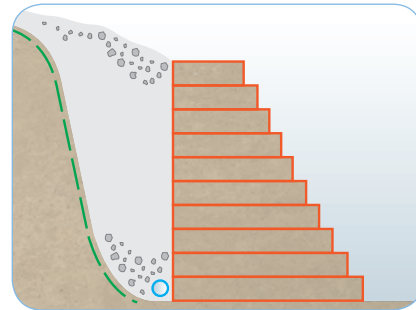
Retaining Walls

In order to stabilise very steep slopes, retaining walls are constructed. Traditional retaining wall structures are constructed of concrete blocks or wooden fascia combined with one or more layers of reinforcement (geogrids, metal strips etc.) extending into the soil mass.

This type of wall can be very expensive due to the cost of the fascia materials. Instead, using InfraWeb serves as both the fascia and the reinforcing element. The cells not only hold the soil in place, they also provide drainage throughout the structure.

An InfraWeb gravity wall is constructed by filling the cells with local, soil and/or aggregate. An additional benefit is that the outer cells can be vegetated, thus giving the wall a pleasing and environmentally compatible look.

The size of the expanded InfraWeb panels increases the effective thickness of the retaining wall. This in turn enables the construction of walls of considerable height without resorting to the use of additional reinforcing elements.



Retaining Walls



Retaining Walls



Retaining Walls

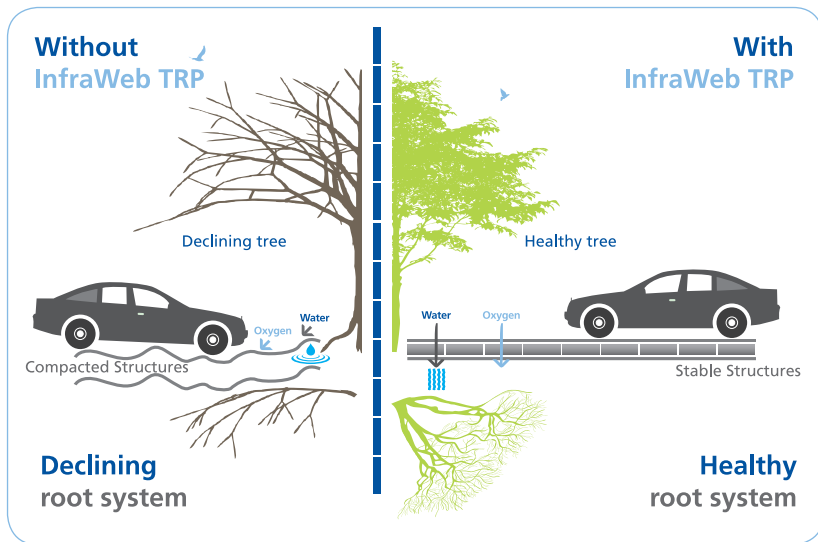


Retaining Walls

Tree Root Protection

Vehicular traffic over unprotected areas within the tree root protection zones of existing trees causes compaction of sub soils leading to reduced voids within the soil structure. This reduces air and water transfer to the roots themselves which can ultimately lead to the root structure declining and the eventual loss of the tree.

InfraWeb can be used to create a hard wearing, stable and free draining structure to prevent soil compaction whilst maintaining water and air flow to the tree roots. A 4/20 or 20/40 clean, angular stone is used for infill in this application and this material will always be more permeable.



Tree Root Protection



Tree Root Protection



Tree Root Protection

Technical Specifications

Physical Properties

Longterm 50 year Performance Guarantee

InfraWeb is guaranteed to be durable for a minimum of **50 years** in natural soils with 4<pH<9 and soil temperatures of up to 25 deg C.

Material	HDPE	Test Method
Density (gr/cm ³)	ASTM D1505	ASTM D1505
Wall Thickness (mm): Smooth Textured	1.25 + 0.15	ASTM D5199
	min 1.25 + 0.15 max 1.52 + 0.15	
Carbon Black Content (%) ^a	2.0 + 0.5	
Seam Tensile Peel Strength (N/cm)	145	ASTM 4437
ESCR (min hrs)	3000	ASTM 1693
Type of weld	Ultrasonic	a. For black only
Wall Type	Smooth, textured	b. Other colours available upon request
Colors ^b	Black, Tan, Green	

Dimensions

InfraWeb GS (Ground Stabilisation) - Cell Depths: 75mm, 100mm 150mm, 200mm										
Type ^a	Diagonal length (cm)	No. of cells/m ²	Cell area (cm ²)	Expanded Panel Dimensions		Weight per panel (Kg)				
				Unit Width (m)	*Unit Length (m)	50mm	75mm	100mm	150mm	200mm
GS10	49.1	8.3	1208	2.42	7.90	n/a	7.7	10.2	15.3	20.4
GS15	40.8	12.0	832	2.42	8.15	n/a	9.5	12.7	19.1	25.5
GS20	34.8	16.5	607	2.42	8.00	n/a	11.0	14.6	22.0	29.3
GS25	30.4	21.7	461	2.42	7.90	n/a	12.4	16.5	24.8	33.1
GS30	26.9	27.6	362	2.42	8.05	n/a	14.3	19.1	28.6	38.2
GS35	24.2	34.3	292	2.42	8.00	n/a	15.8	21.0	31.5	42.0
GS45	21.9	41.7	240	2.42	8.10	n/a	17.7	23.5	35.3	47.1
InfraWeb VR (Verge Reinforcement) - Cell Depths: 150mm, 200mm										
VR	24.2	34.3	292	0.96	8.00	n/a	n/a	n/a	12.5	16.7
InfraWeb RW (Retaining Wall) - Cell Depths: 150mm, 200mm										
RW	30.4	21.7	461	2.42	1.22	n/a	n/a	n/a	3.85	5.10
RW	30.4	21.7	461	2.42	1.82	n/a	n/a	n/a	5.75	7.65
InfraWeb TRP (Tree root Protection) - Cell Depths: 50mm, 75mm, 100mm 150mm, 200mm										
TRP	24.2	34.3	292	2.42	8.00	10.5	15.8	21.0	31.5	42.0

*For bespoke orders and based upon minimum order quantities, the unit length can be adjusted according to project specific requirements.

Other products by **InfraGreen** SOLUTIONS

Infra Green offer plastic permeable paving systems to cover a wide range of applications from simple footpaths and temporary car parking to fully engineered grass and gravel paving systems for heavy goods vehicle parking areas.

Infra Green's full product range includes:

- Plastic paving grids for grass and gravel infill
- ArborRaft tree planting systems
- TreeBox HP tree planting systems
- Tree soils and rootzones
- Turf protection
- Geotechnical products
- Drainage systems for sports fields
- Lightweight base systems for rooftop sports and play areas

For further information on any of our products, please contact our office on 01509 615100 or email civils@polypipe.com

Infra Green can offer:

- Design services
- Onsite support
- Stock holding
- Next day delivery



Plastic paving



ArborRaft



TreeBox HP



Sports Pitch Drainage



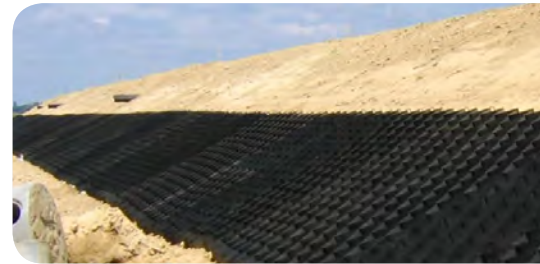
Rooftop Sports and Play areas



Creating Green Infrastructure

InfraWeb

Cellular confinement system



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