vertical greening systems for urban architecture

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vertical greening systems for urban architecture

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Vertical Greening Systems for Architecture

INTRO

- The thermoregulatory function of vegetation in summer has been known since ancient times throughout the Mediterranean area.
- The earliest form of vertical gardens dates from 2000 years ago in the Mediterranean region and ornamental roof gardens have been developed initially by the civilization of the Tigri and Euphrates River valleys (the most famous examples of which were the Hanging Gardens of Babylon in the seventh and eight centuries B. C.
- Several examples of green roofs and façades back to 18th-19th century can be found in North Europe regions, such as sod roofs in Norway, or climbing plants for shading vertical surfaces in Mediterranean regions.
- Cities such as Naples, Rome, Firenze and Milano often used planting covering the façades to embellish their front and to reduce Summer solar heating.
- The microclimatic variations, connected to the use of vegetation integrated in the building, derive mainly from a reduction of the incoming thermal flow through shading, the reflection of solar radiation, the reduction of convective exchange and the absorption of solar energy used for photosynthetic processes and thermal energy used in evapo-transpiration processes.
- The importance of this can be understood by considering the current summer microclimatic discomfort in urban environments, caused by the overheating of the air and due both to the heat, dust and pollutants produced by urban activities and the conformation of the fabric of the city.
- In the centre of large cities, the concentration of built-up areas and street paving, together with the high thermal conductivity of most building materials, results in 10% more solar energy being absorbed than in a corresponding area covered by vegetation.
- The accumulation of thermal energy and the difficulty to disperse it in space are also due to the shape of urban spaces, often characterised by intensive building.
- In the presence of roadways that are narrower than the height of the buildings, there are multiple effects of reflection of thermal radiation between the walls of the buildings, with consequent heating of the air masses with which they are in contact.
-

Vertical Greening Systems for Architecture

- Green areas as a tool for controlling the microclimate of urban spaces.
- In the spaces inhabited by mankind, the use of vegetation has always had multiple functions, from the symbolic, aesthetic or ornamental to the productive and regulation of the microclimate.
- The integration of greenery with the built environment is particularly important today, especially as a valid solution to environmental discomfort and pollution in urban areas.
- In the current Italian towns planning, however, the functions assigned to green areas are only those prescribed by the town planning standards, which envisage the obligation of an abstract ratio between the quantity of areas to be allocated to services (not exclusively to public green areas) and those to be allocated to buildings for settlements, within the functional areas of the plan.
- As part of the research on energy conservation and saving, stimulated by the energy crisis of the Seventies, carried out first in the USA and then in Europe (Germany, Holland, Great Britain, etc.), the function of vegetation was highlighted, stimulating its "environmental" use for the comfort of anthropic environments.
- An ecological approach to the design and management of the city was born and began to develop, based on the control of environmental variables and also oriented towards the integration of green spaces.
- In the context of an emerging environmental conscience, and in the face of the environmental imbalances of the contemporary city, the idea of a "green city" is thus taking shape; that is to say, a re-naturalization of the city by means of real urban greening initiatives, through the creation of natural and artificial plant corridors, especially where horizontal space does not allow for the insertion of further appropriate green spaces.
- Green areas are far from being considered merely decorative, especially as they can make a significant contribution to improving the quality of life, as part of an ecological vision of urban space.
- In this direction, the redesigning of disused areas on a large scale, as well as all the re-organization and planting of minor urban spaces (residual areas and courtyards), are valid opportunities for interventions.

Milano, Italy

Housing complex, Piazza Sant’Erasmo, 1943

Milano, Italy

Housing complex,
Via Vaina, 1938

Roma, Italy

Rione Monti, 2020

Vertical Greening Systems for Architecture

- Thus, in addition to the traditional types of public green, such as natural and equipped parks, avenues and squares, new types of private urban green are emerging (green courtyards, green walls, green roofs) that can actively contribute both to energy saving and to the conservation of biodiversity on an urban and metropolitan scale.
- The functions of urban greenery for environmental control, which to date have been recognized and demonstrated on a scientific basis, are those of are those of:
- - microclimatic variations (temperature, humidity, wind and air circulation);
- - air circulation and purification;
- - production;
- - noise attenuation;
- - antiseptic action;
- - soil protection;
- - water purification;
- - conservation of biodiversity;
- - psychological function.

Vertical Greening Systems for Architecture

- To avoid being too didactic and boring the keynote here will be simply presenting a summary of the systems/companies - list that is pretty much a continuous work in progress - that are offering integration technologies/systems of greenery in architecture.
- As design Studio we usually design and integrate those solutions in our projects and then we call in suppliers as these ones.
- Disclaimer: We are not associated - nor in partnership - nor promoting any of these companies.
- They remain Owners of their copyrighted materials/technologies: Internationally valid. Always contact them directly and as always Do Not Copy!
- The list is subject of daily changes and doesn't want / pretend to be exhaustive.
- We remain available for Consultations on Your next project.

Vertical Greening Systems for Architecture

Classification of Vertical Greening Systems for Architecture

Definition	Function	Product Name
Greening system vertical juxtaposed to the perimeter wall of a building	-Total or discontinuous of the facades of a building; - Vegetative cladding of new or existing parapets and new or existing fences; - Solar screening; - Improving the aesthetic appearance of the facades of an existing building; - Cooling of the internal environments of a building in the summer period; - Reduction of summer energy consumption of a building; - Oxygen production;	- Gittersysteme; - “Green Wall” Cable Trellis System; - Green Wall Containers; - GRIPPLE®; - Seilsysteme; - TENAX® Extensible Trellis - …
Greening system integrated with the architectural envelope	- Reduction of heat loss; - Protection from direct solar radiation direct; - Natural cooling of indoor interiors; - Reduction of the energy consumption of a building; - Oxygen production;	- Patrick Blanc Patent; - ELT Easy Green™ Living Wall; - Green Living™ Wall; - prototype: Reviwall® - prototype: Poliflor System - Vegetalis® - Vertiss® - Vertical Field - …

Classification of Vertical Greening Systems for Architecture

Definition	Function	Product Name
Vertical greening system vertical for green walls of containment	- Green containment wall for the stabilization of the underpass and freeway; - Rockfall wall; - Bikeway support; - Masking of retaining walls in reinforced concrete to reduce environmental impact; - Oxygen production.	- Geomuro®; - Samer Green Wall - Löffelstein® Vegetable Wall; - Krainer Wall - Permacrib®; - Prototype: Revitalus®; - Splitflower; - Reinforced Earth
Greening system vertical of insulated elements	- Fencing of private spaces; - Soundproof acoustic barrier; - Windbreak; - Solar shading of a terrace or an outdoor space; - Plant barrier to recreate outdoor of privacy; - Oxygen production;	- CONFINA Mobilane®; - Green green screen; - Canevaflor® Vegetable Wall; - Grid panels; - SEMIRAMIDE; - Baerma® system

Wall

Gittersysteme

Thomas Brandmeier - Begrünungssysteme GmbH is a German company that manufactures metal support and anchorage systems (cables, stretched wires and stainless steel nets) for supporting and guiding climbing plants.

Note

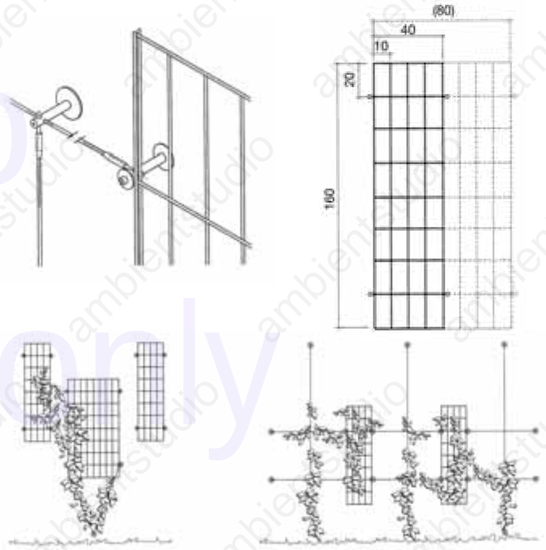
Company details

Thomas Brandmeier – Begrünungssysteme GmbH
Reutackerstr. 12
D-79591 Eimeldingen
Germany
Tel. +49 7621 705610
Fax +49 7621 7056123
Website: www.brandmeier.de
E-mail: info@brandmeier.de

References

Product type

Gittersysteme is a greening system with climbing plants for the perimeter walls of a building. The system consists of one or more nets in stainless steel nets that are anchored to the facade through particular spacers, defined by cylindrical elements in stainless steel fixed to the wall by screws by means of screws and plugs, depending on the material of the facade.
Various standard sizes of wire mesh are commercially available, characterized also by different widths for the meshes. Also their distance from the wall can vary from 9 to 15 cm depending on the need. Each wire mesh can be anchored to the facade in isolation or, if necessary, can become a modular element, which is fixed to the wall one after the other in a to each other horizontally, hooking laterally to the common spacers arranged punctually along the surface of the wall.
This façade greening system can also be combined with a support structure for climbers made of stainless steel cables, arranged at right angles and tensioned at their ends by means of by means of special traction devices. The stretched cables to be used must have a diameter of 4 mm and have the function of directing the growth of the creeper, while the net can help extend and thicken the foliage.
The use of this combination of systems is suitable for the greening of walls of a multi-story building. Efficient use of these metal façade planting systems requires that the creepers are properly planted in the ground in the vicinity of the wall to be greened.



Details

Technical Data

Dimensional characteristics of stainless steel meshes

standard size of mesh stainless steel	dimensions of the mesh of the net	distance of the net from the wall
160 x 40 [cm]	10 x 20 [cm]	9 [cm]
160 x 80 [cm]	10 x 20 [cm]	9 [cm]
160 x 32 [cm]	8 x 20 [cm]	15 [cm]

The data shown is taken from the company catalog of Thomas Brandmeier - Begrünungssystems GmbH

The plant essences that lend themselves to be supported by this coating system can be different, such as:
- Hedera Helix: this climbing plant, also called "gold of bogliasco", is resistant and evergreen. It has small bright green leaves, spotted with yellow in the center.
- Jasminum officinale 'Aureum': this climbing plant is delicate and deciduous and has mottled soft yellow leaves.
- Trachelospermum jasminoides: this creeper, known as "false jasmine", is evergreen and hardy. It produces clusters of white flowers in the summer season.

Essences vegetable

Wall

“Green Wall” Cable Trellis System

S3i Ltd is a British company that manufactures and distributes a wide range of steel products such as cables, ropes and anchoring and joining systems and union of the same, which can be used both in structural design, architectural structural, architectural and landscape design.

Note

Company details

S3i Ltd
The Old Cafè, Hudson’s Yard
Doncaster Road, Bawtry
Doncaster DN10 6NX
England
Tel. +44 (0) 1302 714513
Fax +44 (0) 1302 714532
Website: www.s3i.co.uk
E-mail: info@s3i.co.uk

References

Product type

"Green Wall" Cable Trellis System is a metal trellis composed of a system of stainless steel cables stretched and arranged in a trellis in order to create a support structure to cover the perimeter walls of a building with climbing plants. The system is composed of cylindrical elements ("hubs") in stainless steel on which are anchored and stretched a series of stainless steel cables. Stainless steel cables are anchored and stretched at right angles, so as to create the support trellis that can take, depending on the needs, different configurations. Each hub is placed at a distance of about 50 cm from the next and is punctually anchored to the perimeter wall of the building by means of a dowel with an internal screw. This fixing can be reinforced with the addition of a possible chemical binder in the hole of the masonry in order to ensure greater stability to the metal lattice in case it has to bear the weight of very large climbing plants. Through each hub are made to pass the metal cables, which are pulled and put in tension by tightening the central screw placed on the top of each hub. Subsequently, the protruding end of the metal cables is covered with a special plastic cap to ensure a good seal to the tie rods that make up the lattice.
This system of covering the perimeter walls with plant essences is particularly suitable for improving, in addition to the aesthetic appearance of the facade of a building, even the microclimate of the interior, helping to reduce energy consumption in summer.

Details

Technical Data

Dimensions of mirror polished stainless steel hub

	L	L2	OD
hub	30 [mm]	27 [mm]	22 [mm]

Components and dimensions of the basic metal lattice (2x1 m):

	dimensions	number of components
stainless steel cylindrical hub	Diameter Φ = 22 [mm] height H = 42 [mm]	15

The data shown is taken from the company catalog of S3i Ltd.

The plant essences that lend themselves to be supported by this coating system can be different, such as:
- Akebia quinata: this vigorous and flexible climber is deciduous andevergreen. It produces reddish purple flowers in late spring, followed by pod-shaped fruits.
- Clematis orientalis: this deciduous climber is hardy and sturdy with fern-like leaves. It has yellow star-shaped flowers that bloom between late summer and mid-autumn.
- Jasminum officinale 'Aureum': this climbing plant is delicate and deciduous and has mottled soft yellow leaves.

Essences vegetable

Wall

Green Wall Containers

Eco Innovations Inc. (dba "Green Roof Tops") is a company that deals with the dealing with green roof tops and green walls. Its patent is registered under the name of G-SKY, green roofs and walls.

Note

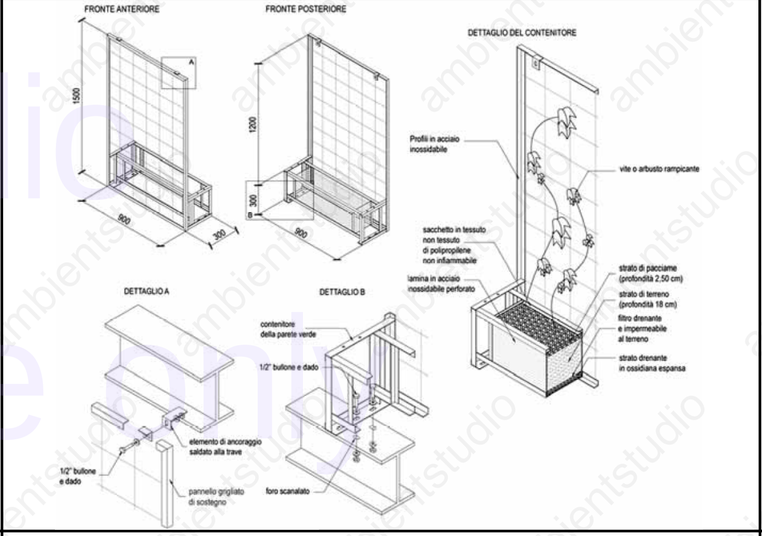
Company details

G-Sky Green Walls and Roofs
669 Ridley Place, Unit 208
Delta, BC (Annacis Island)
V3M 6Y9
Canada
Tel. +604 708 0611
Fax +604 357 1315
Website: www.greenrooftops.com, www.g-sky.com
E-mail: eliot@g-sky.com, info@greenrooftops.com

References

Product type

Green Wall Containers is a system of facade greening, which consists of covering the perimeter wall with a succession of pots, equipped with a support element for climbing plants and arranged in a row for the entire height of the building. The system is made entirely of metal and the elementary module consists of a grid panel composed of a grating panel for the support of plant essences, constituted by a stainless steel grid framed by metal profiles which are anchored in the lower section to a perforated stainless steel container, where the creepers are grown. Each grid panel has a size of 900 x 1500 mm in order to allow a thick and rapid growth of the vines along the entire surface of the grid.
This greening system is anchored to the façade through a structural steel frame, which must provide an access between the perimeter wall and the metal containers of the plants for maintenance. This solution is able to keep at the same time the climbing plants away from the construction and easy to remove if necessary. This greening method is also suitable for discontinuous façade coverings.In fact, when for structural, functional or aesthetic reasons it is not possible to completely cover the perimeter wall of a building with plants. This greening system characterizes the appearance of the building that is marked by the alternation of horizontal plant bands with uncovered parts of the envelope.



Details

Technical Data

Material and dimensional characteristics of the single module of the system Green Wall Containers, composed of grating panel and container vase.

	material	dimensions
panel grating	stainless steel grid deoxidized mounted on metal profiles	L 900 x H 900 ÷ 1500 [mm]
mesh	acciaio inossidabile deossidato	100 ÷ 150 [mm]

Data shown are from the corporate catalog of Eco Innovations Inc.

Various plant essences can be used, such as:

- Clematis armandii: this deciduous climber is hardy and robust with leaves fern-like leaves. It has yellow flowers that bloom between late summer and mid-autumn.
- Hedera Helix: this climbing plant is hardy and evergreen. It has small bright green leaves, mottled with yellow in the center.
- Jasminum officinale 'Aureum': this climbing plant is delicate and deciduous and has mottled soft yellow leaves.
- Parthenocissus tricuspidata: this climber is hardy and deciduous with leaves that fade to shades of scarlet in the fall.
- Passiflora cerulea: this evergreen climber produces flowers with white petals and purplish-blue stamens.
- Thunbergia alata: this annual climber is a semi-hardy climber that produces white, yellow or orange from early summer through early fall.

Essences vegetable

Wall

GRIPPLE®

Gripple Limited is a British company that manufactures and distributes splicing and stretching systems of nylon threads for the support of plant essences.

Note

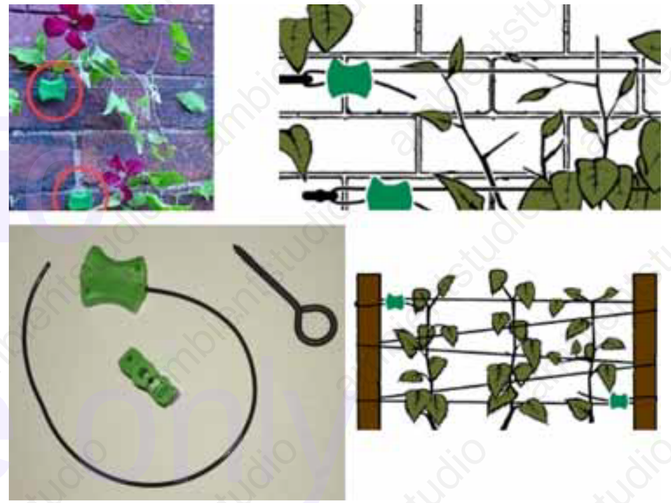
Company details

Gripple Limited
The Old West Gun Works
Savile Street East
S4 7UQ Sheffield
United Kingdom
Tel. +44 (0) 114 275 2255
Fax +44 (0) 114 275 1155
Website: www.gripplegarden.com
E-mail: gardeninfo@gripple.com

References

Product type

GRIPPLE® is a system for the support of plant essences for the coating of facades, parapets and fences. The system is composed of green clamps made of nylon reinforced with fiberglass, which have the function of joining and putting in tension nylon threads to create a stretched structure, which can be arranged horizontally or in zigzags for the support of plant essences. The nylon thread is UV-stabilized, so as not to deteriorate under direct sunlight, ensuring a duration of about 15 years. Each joining and tensioning clamp contains stainless steel springs with small rollers that allow the stainless steel springs with small rollers, which allow the nylon thread to slide in one direction, but immediately and automatically block the sliding in the opposite direction. This means that tension can be applied several times in succession. All parts of each clamp are made of corrosion-resistant material in order to allow further reuse without problems. The tensioned structure thus configured is then anchored to the facade by means of dowels equipped with eye bolts for masonry.
This greening system has the following functional characteristics there is no presence of knots; no effort arises to twist the wire; there is no danger of injury from sharp-tipped iron wires; no tools are required since the tensioning is easily done by hand.



Details

Technical Data

Material and dimensional characteristics of the single module of the system
Green Wall Containers, composed of grating panel and container vase.

components of the system	size components	Pieces - Quantity per package
GRIPPLE clamp	----	10
nylon thread	diameter Φ = 3 [mm]	hank of 50 [m]
eye bolt for wall	length = 7 [cm]	20

GRIPPLE clamps can withstand up to 100 kg of load.

Data shown is taken from the Gripple Limited company catalog.

The plant essences that lend themselves to be supported by this coating system can be different, such as:
- Clematis "Frances Rivis": this deciduous climber produces flowers bluish purple pendulous flowers between the middle and end of the summer season.
- Jasminum nudiflorum: this shrub is robust and deciduous with flexible branches on which flowers bloom in shades of light yellow from late fall to late spring.
- Lathyrus odoratus: this plant, known as "sweet pea", produces clusters of red, pink and purple flowers during the summer season.
- Maurandella antirrhiniflora: this perennial plant produces flowers in shades of purple and yellow starting in late spring through fall.
- Wisteria floribunda: this climber, also known as 'wisteria', is sturdy and deciduous. It produces purplish blue flowers in hanging clusters up to 30 cm between the end of the spring season and the end of the summer season.

Essences vegetable

Wall

Seilsysteme

Thomas Brandmeier - Begrünungssysteme GmbH is a German company that manufactures metal support and anchorage systems (cables, stretched wires and stainless steel nets) for supporting and guiding climbing plants.

Note

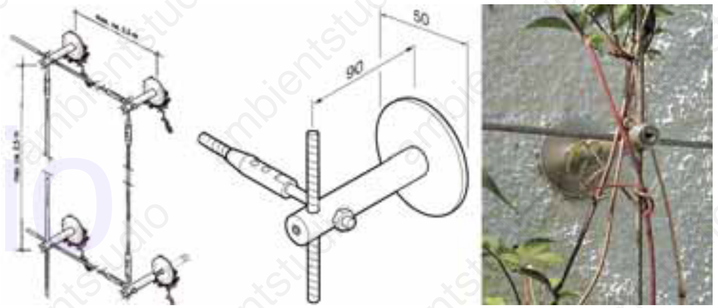
Company details

Thomas Brandmeier – Begrünungssysteme GmbH
Reutackerstr. 12
D-79591 Eimeldingen
Germany
Tel. +49 7621 705610
Fax +49 7621 7056123
Website: www.brandmeier.de
E-mail: info@brandmeier.de

References

Product type

Seilsysteme is a system of metal cables supporting climbing plants to be used for the covering of the perimeter walls of buildings. This system consists of stainless steel cables arranged orthogonally in such a way as to form a grid structure for the support of climbing plants. Depending on the requirements, the metal cables can be arranged in such a way as to create grids with different mesh sizes up to a maximum of 2.5 m x 2.5 m. The wire cables used have a diameter of 4 mm and are tensioned at their ends by means of special traction devices fixed to the perimeter wall by means of point anchors. The latter consist of cylindrical elements with internal screw both in stainless steel, which define the nodes of the grid. With this method of fixing the metal cables have a distance of about 9 cm from the perimeter wall of the building.



Details

Technical Data

	cable distance from the wall	insulation layer thickness
Anchorage on wood: flat self-tapping steel screw	9 cm	
Anchorage on concrete: masonry and stone materials internal screw, dowel and mortar	9 cm	
Anchorage on perforated bricks and limestone materials dowel with protection and mortar	9 cm	
Anchorage on wall with coat insulation screw with internal thread and inert filler	9 cm	8 cm
	9 cm	12 cm
	9 cm	14 cm

The data shown is taken from the company catalog of Thomas Brandmeier - Begrünungssysteme GmbH

The plant essences that lend themselves to be supported by this coating system can be different, such as:
- Akebia quinata: this vigorous and flexible climber is deciduous and evergreen. It produces reddish purple flowers in late spring, followed by pod-shaped fruits.
- Clematis orientalis: this deciduous climber is hardy and sturdy with fern-like leaves. It has yellow star-shaped flowers that bloom between late summer and mid-autumn.
- Hedera Helix: this climbing plant, also called "gold of bogliasco", is hardy and evergreen. It has small bright green leaves, mottled with yellow in the center.
- Lonicera periclymenum: this hardy, deciduous climber produces purplish red flowers between the summer and fall seasons.
- Parthenocissus quinquefolia: this climber, also known as the "vine of Canada", is hardy and deciduous with pentalobate leaves that in autumn have shades that vary in shades of scarlet red and orange.
- Parthenocissus tricuspidata: this climber, also known as "American vine" is hardy and deciduous with leaves that shade into scarlet hues in the fall.

Essences vegetable

Wall

TENAX Extensible Trellis

Tenax s.p.a. is an Italian company that manufactures products (trellises extensible, nets, grating panels) for the construction of green spaces that concern the garden, the vegetable garden, but also the house, offering solutions of guaranteed quality and easy execution.

Note

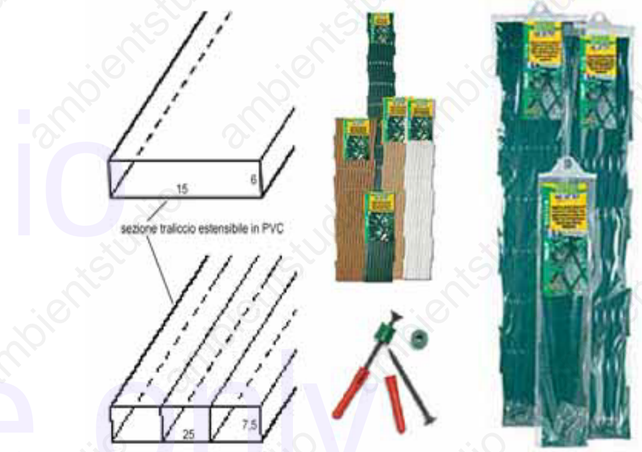
Company details

TENAX s.p.a.
Divisione Home & Garden
via dell'Industria 3
23897 Viganò (LC)
Italia
Tel. +39 039 9219300
Fax +39 039 9219290
Website: www.tenax.net
E-mail: customer.service@tenax.net

References

Product type

The extensible trellis TENAX is a support for climbing plants to be used for the vegetal covering of the perimeter walls of a building. The trellis is made of PVC and is UV-stabilized to maintain its color and structure over time. This support is light and manageable and does not require any maintenance, lending itself to be a viable and long-lasting alternative to wooden and bamboo trellises to support and facilitate the growth of flowers and climbing plants behind walls or columns in a garden. The extensible meshes of this trellis are realized in different dimensions and they can be 25x7,5 mm or 15x6 mm according to the model adopted. The color shades of the product are also different and currently available in green, brown, white or natural color.
The installation of this support for climbing plants is done by the desired height and width on the perimeter wall. Then the masonry is drilled where the dowels are introduced in correspondence of which are placed the cylindrical elements to distance the support from the wall. Finally, the truss is fixed to the wall by means of screws that block the cylindrical elements passing through the tessellations previously inserted. During the installation is advisable not to tighten screws too tight to prevent the truss from deforming.



Details

Technical Data

Dimensional characteristics of TENAX extensible trusses.

TREPLAS truss dimensions	TRELIT truss dimensions [m]	color
	0,5 x 1,5 [m]	green
0,5 x 2 [m]		green
1 x 1 [m]		green

The data are taken from the company catalog of TENAX s.p.a.

Several plants are used for outdoors, such as:
- Clematis "Frances Rivis": This deciduous climber produces bluish purple pendulous flowers between the middle and the end of the summer season.
- Hedera Helix: this climbing plant is hardy and evergreen. It has small bright green leaves, mottled with yellow in the center.
- Lonicera nitida: shrubby evergreen plant is deciduous and climbing with small leaves. It produces white flowers followed by dark berries.
- Parthenocissus tricuspidata: this climber is hardy and deciduous with leaves that fade to shades of scarlet in the fall.
- Passiflora cerulea: this evergreen climber produces flowers with white petals and purplish blue stamens.

Essences vegetable

Wall

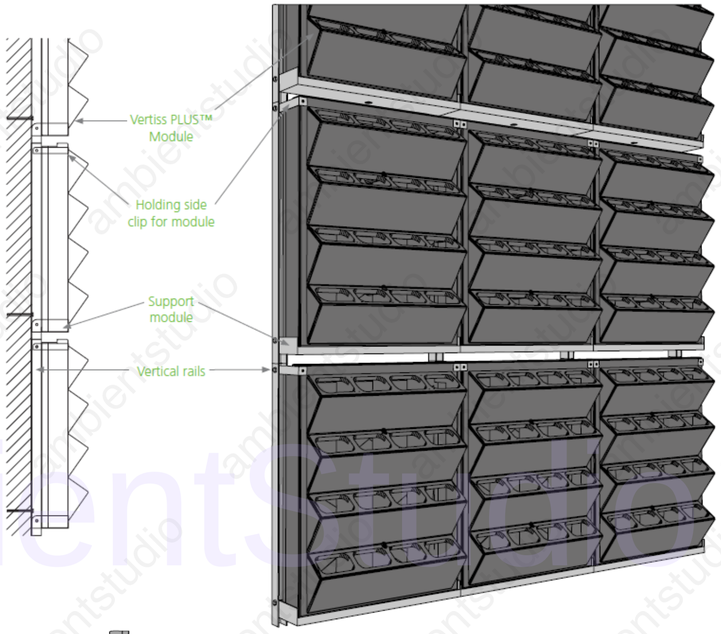
Vertiss PLUS

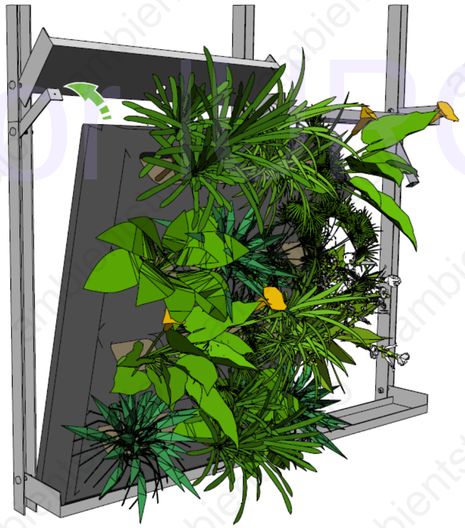
Green Wall Concept

Company details

Novintiss 4, rue Henry Crespin 17000 La Rochelle
Tel. 05 46 51 02 01
Fax 05 46 51 18 98
Website: www.vertiss.net
E-mail: info@vertiss.net

For practical reasons, we recommend that you perform the installation of the modules line by line so that each time pass over the drip line.
For mounting the sprinkler system as a whole, thank you to refer to the corresponding instructions.





Wall

ELT Easy Green™ Living Wall

Elevated Landscape Technologies Inc. (ELT) is a company that has the development of technologies according to the principles of sustainability. Founded in 2001 in Ontario (Canada), in 2004 it developed its own system and entered the market of green roofs and green walls.

Note

Company details

ELT Easy Green
245 King George Rd., Suite 319
Brandtford, Ontario
N3R 7N7
Canada
Tel. (+1) 866 306 7773
Fax (+1) 866 831 3035
Website: www.eltlivingwalls.com
E-mail: info@eltlivingwalls.com

References

Product type

ELT Easy Green™ Living Wall is a greening system that can be used to cover with vegetal essences both the external façade of a building and the construction, terrace parapets or the interior walls of a building, when properly illuminated. The system consists of a black panel high density polyethylene panel, divided into cells in which the substrate (soil) for the cultivation of plants is placed. Each panel is modular and can be joined to others to cover very large wall surfaces.
The anchorage to the facade takes place by fixing to the wall through screws a series of metal bands arranged in succession, so that each module can then be fixed to them by screws along its upper and lower sides.
Each panel allows an easy circulation of the water flow inside without carrying away the cultivation soil. It is in fact equipped with a series of grooves that channel and make the water flow along the back, from the top to the bottom, from cell to cell and then to the panel below. The design of the module has been thought to leave even a minimal of water reservoir in each cell to ensure the water needs of the plant during periods of drought. This mode of greening is also suitable for discontinuous coverings of the facade, characterizing the appearance of the building with the alternation of horizontal or vertical green bands with uncovered parts of the envelope.

Details

Technical Data

Material and dimensional characteristics of the single ELT modular panel
Easy Green™ Living Wall.

panel material	recycled plastic high density polyethylene HDPE
panel dimensions	L 50 x P 6,4 x H 50 [cm]
number of panel cells	45
panel color	nero
UV resistance	UV stable
chemical resistance	yes
product warranty	15 years

The data shown is taken from the ELT Easy Green company catalog.

Several plants are used for outdoor purposes, such as:
- Ajuga: a small perennial plant with linear leaves with an almost entire or just lobed. It has asymmetrical flowers in different shades of colors.
- Hedera Helix: this climbing plant is resistant and evergreen. It has small bright green leaves, mottled with yellow in the center.
- Liriope: herbaceous perennial and evergreen plant is adorned with beautiful flower spikes in shades of light blue-purple.
- Sedum acre: small fleshy plant of herbaceous appearance is creeping, perennial and evergreen.
- Sedum album: small succulent plant of herbaceous appearance is creeping, perennial and evergreen.
- Sedum reflexum: plant with creeping stolons and erect branches bearing flowers.
- Sedum sarmentosum: small herbaceous plant, evergreen and perennial. It grows covering all the soil at its disposal.
- Sedum Sexangulare: herbaceous perennial plant has fleshy and glabrous leaves of cylindrical shape. It produces golden yellow flowers held by a short peduncle.
- Sedum spurium: herbaceous evergreen perennial plant has fleshy reddish-green leaves. It produces carmine red and pink flowers.

Essences vegetable

Wall

Green Living™ Wall

Barthelmes Manufacturing Company Incorporated is a U.S. company that produces sheet metal and metal components for different uses. Among its products it also produces for the realization of green walls for architecture and interior design.

Note

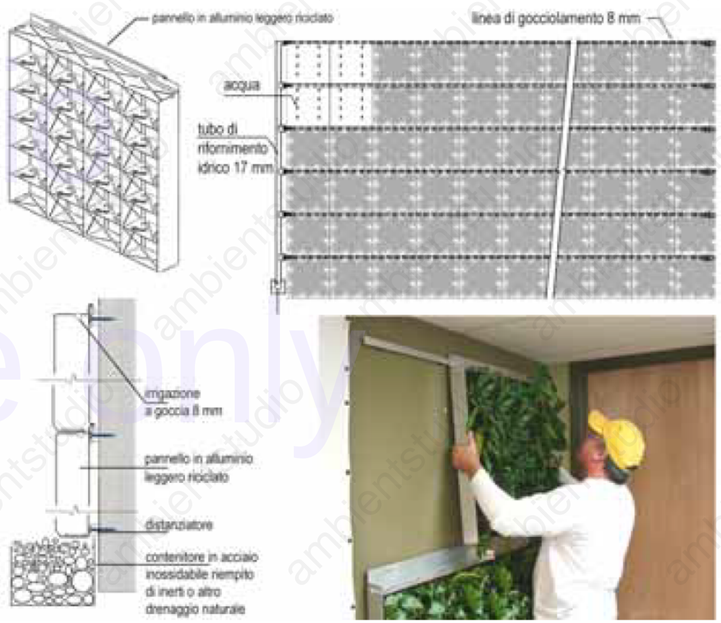
Company details

Barthelmes Manufacturing Company Inc.
15 Cairn Street
Rochester, NY 14611
USA
Tel. 585 328 8140
Fax 585 328 5932
Website: www.agreenroof.com, www.barthelmes.com
E-mail: info@agreenroof.com, sales@barthelmes.com

References

Product type

Green Living™ Wall is a greening system for covering the facades of a building, as well as the internal vertical partitions of a building or the fences of public or private spaces with plants. The system consists of a recycled and stainless lightweight aluminum panel, which is divided inside into cells, patented to deposit the substrate (soil) for cultivation and allow an adequate water supply to the plants with a free drainage of irrigation water. Each panel is modular and can therefore be assembled together with others to cover large external or internal walls, when properly suitably illuminated. The panel is attached to the facade by attaching linear metal profiles to the surface of the wall, arranged horizontally and in vertical rows in order to allow each module to be anchored to them along its upper and lower edges by means of screws. All the panels have been designed to have also an efficient circulation of the flow of water inside without removing the growing medium of the plants. In fact, each module is equipped with a groove on the top to accommodate housing the drip irrigation pipe, which is distributed linearly along the entire length of the planned plant covering. Through this irrigation system, the water flows from top to bottom along the entire panel, managing to reach each cell to ensure a proper water supply to the plant present. This mode of greening is also suitable for curved and discontinuous coverings of the facade of a building, allowing you to alternating plant strips with uncovered parts of the architectural envelope.



Details

The data are taken from the company catalog of MACCAFERRI s.p.a.

Wall

Poliflor System

PROTOTYPE for green wall

Poliflor is an Italian company that produces and distributes systems. Since 2001, it has been committed to the development of its products also through its own research center that collaborates in the field of sector with other European partners (Helix GmbH - Stuttgart, Xeroflor - Bremen, Mobiliane - Netherlands).

Note

Company details

Poliflor s.r.l.
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48026 Faenza (RA)
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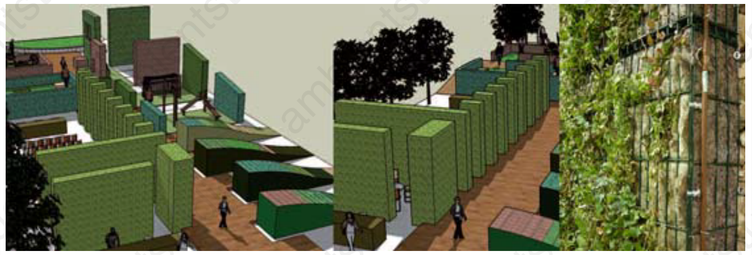
Tel. +39 0546 44154
Fax +39 0546 44444
Website: www.poliflor.net
E-mail: info@poliflor.net



Exhibition of T-GREEN 2008

Product type

The Poliflor system for vertical greenery is a patented vegetal wall to cover the surfaces of the perimeter walls of buildings. The prototype of this system was presented at the first exhibition of Green Technology (T-VERDE, see the website www.t-verde.it), which was the novelty event of the 2008 edition of the Flormart/MIflor at the Padua Fairgrounds. This vegetation wall is composed of a modular cage in green-painted steel inside of which the cultivation substrate is laid out, formed by a mat of different layers of felt, which contains a core of peat and perlite. The latter is a volcanic effusive rock used in granular form as it favors granular form because it favors the water retention of the substrate, so as to contain and retain the water inside the mat in order to ensure an efficient water supply to the different plant species cultivated. The metal cage containing the substrate is made in modules of 1x1 m with about 25 cm depth. Its anchorage to the perimeter wall of a building is provided by means of special fastening elements, equipped with bolts which also have the function of tightening and closing the cage itself.
The irrigation system of this vegetation wall is "drip" and takes place by means of a series of collectors made of plastic material, which, arranged horizontally at different heights of the different heights of the plant wall, penetrate inside the growing substrate contained in the metal cage. The water supply of these collectors are supplied with water through a series of vertical distribution pipes to which they are connected to a series of vertical distribution pipes that run along the entire height of the plant wall.

Images of the prototype

Wall

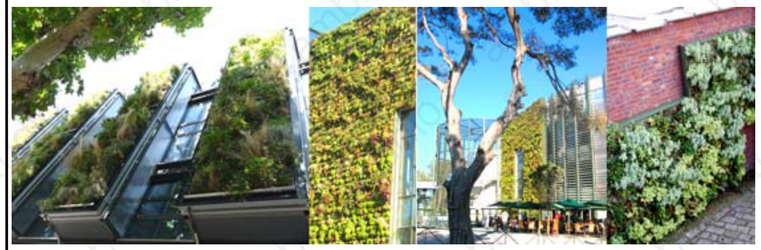
Vegetalis ®

GREENWALL is a French company, founded in 2004, which produces vegetal walls, developed through a three-year research program in collaboration with the CIRAD (French agronomic research of agronomic research for sustainable development in the south). Within its staff, this company has a multidisciplinary team of agronomists, botanists, architects and construction engineers to address all issues on vertical green.

Note

Company details

GREENWALL
Parc d'Innovations Scientifiques et Techniques
131 Impasse des Palmiers
P.I.S.T. Oasis - Bâtiment D
F-30319 Alès Cedex
Francia
Tel. +33 0434 763476
Website: www.greenwall.fr, www.peverelli.it
E-mail: contact@greenwall.fr, info@peverelli.it



References

Product type

Vegetalis® is a plant wall that is used to cover the vertical or curved surfaces of the exterior and interior walls of a building. The wall is composed by several pre-cultivated modules consisting of a cage (greenbox®) in galvanized steel, inside which is placed the substrate of natural cultivation formed by sphagnum moss, which is an extremely light and permeable moss.This substrate has a high capacity for water absorption and allows a good rooting of the plants inside it, allowing the organic cultivation of different plant essences. The metal cage is defined by a net with a mesh of 30 x 30 mm and a diameter of the wires of about 4 mm; each module of the green wall is then mounted through special metal hooks on an anchoring structure, defined by a metal grid, whose profiles are fixed by means of plugs and screws to the wall of the building. The installation of this green wall is carried out in such a way as to leave a ventilated and continuous air gap between the perimeter wall and the building. The use of such greening system allows to protect the building walls from direct solar radiation and to naturally cool the interior spaces, reducing the energy consumption of a building. At the same time, thanks to its density and plant composition, is able to offer good characteristics of insulation and sound absorption and to retain the particulate matter in the atmosphere. The entire green wall can be easily disassembled if necessary and its components can be partly used for composting and partly recycled (steel). The integrated irrigation system is "drip" and consists of micro-drip pipes inserted into the plant substrate, where the irrigated water is then recovered from a collection tank at the base of the wall (or every 2.40 m in height) to be re-used again.

Details

Reviwall ®

PROTOTYPE for vertical greening system integrated to the architectural envelope

Top left: the reversed panel system Reviwall® produced by the company REVIPLANT (www.reviplant.it). This system, presented at SAIE 2008 of the Bologna Fair, allows to realize works of vertical green optimizing fertilizers and water. The modular panel Reviwall® has dimensions of 40x50x3 cm.

Top right: detail of the panel Reviwall® panel. The choice of plants are chosen according to the environment where the the green wall will be placed.

Bottom left: the modular panel Reviwall® consists of an anodized aluminum frame where a three-dimensional polypropylene wrapped by two different draining sheets. Inside the geomat are injected hydrated coconut fiber hydroretentive polymers and inoculums of mycorrhizal mycorrhizal and bacterial promote the rooting and plant development.

Bottom right: the surface of the panel can have different textures.

Vertical garden - patent by Patrick Blanc

Vertical greening system integrated to the architectural envelope

Top left: Quai Branly museum in Paris, dedicated to the art primitive art of the four continents. The facade of the building integrates a vertical garden, the work of botanist Patrick Blanc. (Image source: http://deconarch.wordpress.com)

Bottom left: detail of the plant wall by Patrick Blanc. The greening system consists of rigid plastic panels (PVC) joined by interlocking and on which a polypropylene geotextile, followed by two layers of reinforced polyamide, between which are placed the polypropylene irrigation pipes. The outer felt layer is accompanied by a series of pockets to insert the different plant essences.

Right: the PVC panels panels of Patrick Blanc's vertical garden by Patrick Blanc are anchored to the wall of the building, covered with a waterproofing membrane by means of a metal support structure that creates a cavity to prevent water infiltration.

Wall

GEOMURO ®

HARPO s.p.a. is an Italian company that through its divisions realizes products for the restoration and the structural rehabilitation, for the waterproofing and for civil and environmental engineering. Within its SEIC geotechnical division that proposes in the geosynthetics sector, which offers various technical and creative solutions for different engineering works, such as slope stabilization, soil greening and road design.

Note

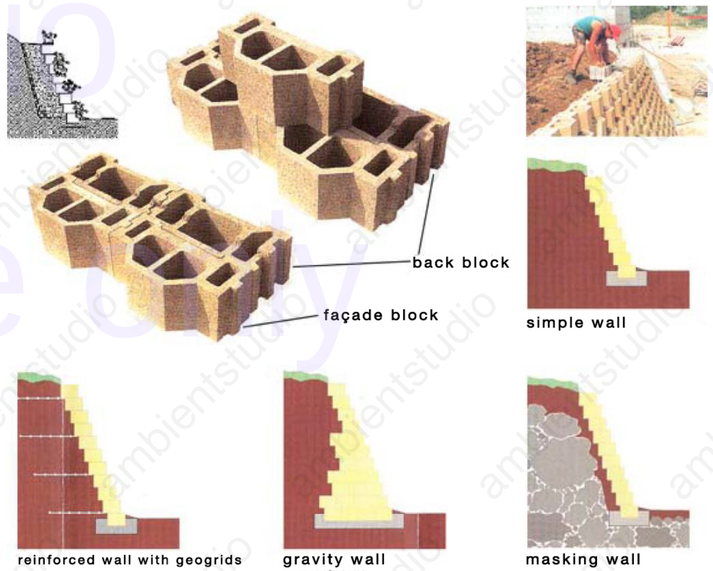
Company details

HARPO s.p.a. - Geotechnical SEIC Division
via Torino 34
34123 Trieste
Italy
Tel. +39 040 3186611
Fax +39 040 3186666
Web site: www.harpo-group.com
E-mail: mastersnc@iol.it

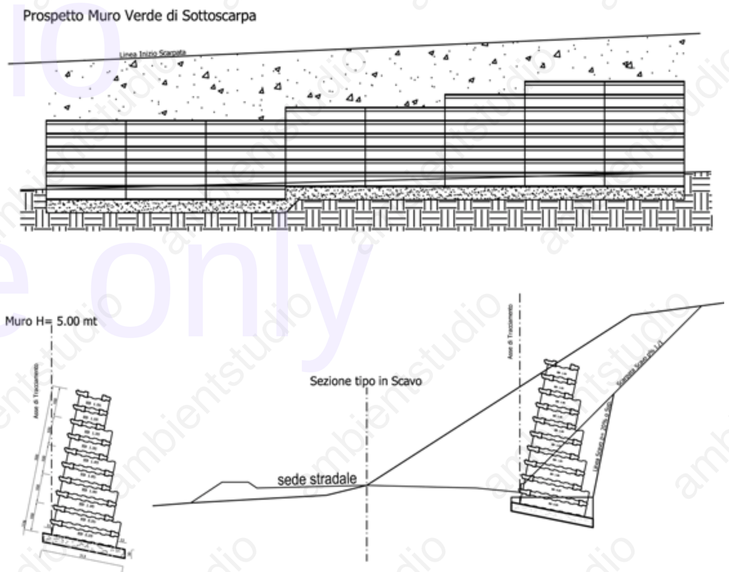
References

Product type

Geomuro® is a modular grassed wall for supporting or masking slopes and embankments and is composed of blocks of vibrocompressed concrete, with internal cavities to be filled with vegetal soil for the cultivation of various species of plants and shrubs. The blocks at the front of the wall have both static and aesthetic, while the rear ones have only structural value. To ensure internal stability of the masonry work the individual blocks are superimposed and assembled together by means of a dry interlocking system, obtained thanks to their geometric configuration that makes accessible the wall as it is built. In addition, the design of the blocks also allows connect the root system of the plant essences with the ground behind, without affecting the continuity of the facade, which can present different types of greening in relation to the landscape and climate. Depending on the needs, the greening masonry work can present different constructive solutions, such as simple walls of reduced height (max 1,5-2 m), obtained by a single row of elements with a total thickness of 25 cm; walls reinforced with geogrids, characterized by a greater height thanks to the overlapping of several rows of blocks, jointly interlocked with each other, and the insertion of reinforcing geogrids at predetermined intervals; gravity walls, realized through the interlocking of various elements in the presence of little space available on the back of the wall; and finally, masking walls used with a purely aesthetic function for the vegetal covering of stable slopes.
In every constructive solution, the face of the wall does not have open spaces between the adjoining blocks in order to avoid progressive washouts of the soil behind.



Details

Wall	Samer green wall	Samer s.p.a. is an Italian company that produces prefabs centrifuged and prestressed. Among its products it also realizes green walls for the containment of the soil of the slopes that delimit roadways in hill and mountain areas.	**Note**
Company details	Samer s.p.a. via Damiano Chiesa 1 88046 Lamezia Terme (CT) Italia Tel. +39 0968 27808 Fax +39 0968 441471 Website: www.samerspa.com E-mail: samer@samerspa.com		**References**
Product type	The Samer green wall is a cellular wall covered with vegetation essences for the support in depth of slopes and unstable slopes easily subjected to landslides and landslides and erosion phenomena. This wall consists of a three-dimensional lattice, consisting of prefabricated elements (beams) in vibrated reinforced concrete overlapping in an alternating manner in the longitudinal and transversal direction in order to realize the gridded containers, characterized by a cage-like framework to contain within them inconsistent material or earth excavated on the spot. Constructed in this way, the cellular walls are, as well as elements of support, also drainage walls, since they allow the disposal of water thanks to the incoherent material they contain. At the same time the configuration of their structure allows the aeration of the wall itself. Their installation takes place with extreme ease and speed, not presenting problems of foundation and adapting perfectly to the course of the ground and any settling processes. This is due to the functional improvement functional improvement obtained from the deformability of their cages in reinforced concrete and the fundamental homogeneity between the masonry structure, the filler material and the natural terrain. After making the excavation, the construction of this wall cellular is performed in laying the precast concrete elements, consisting of beams placed on a suitable foundation to erect the cage load-bearing. Subsequently, the reinforced concrete structure is gradually filled with the fill soil material and then plants and shrubs are inserted in a horizontal position between the concrete crossbeams.		**Details**

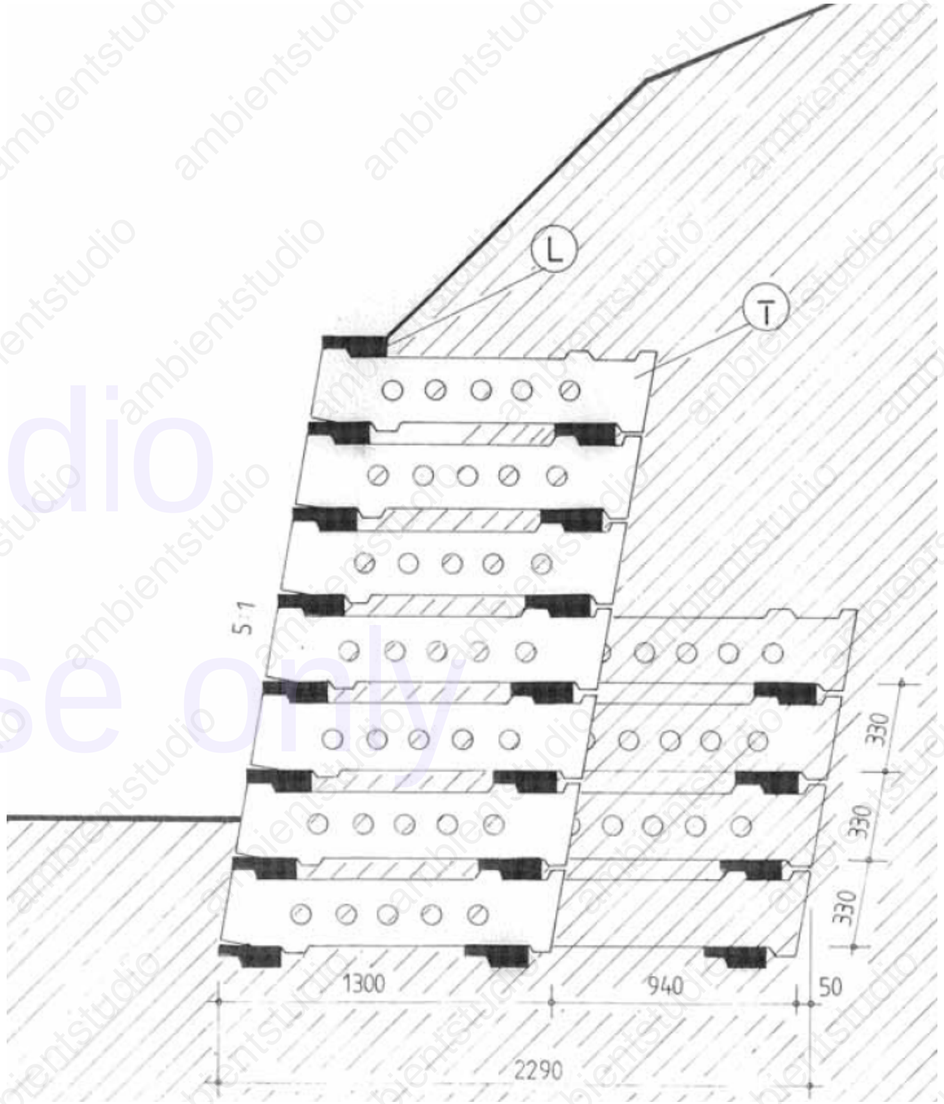
Krainer Wall ®

Vertical greening system for green retaining walls

Fig. 5 - Left: On the surface of the Reviwall® panel has six pockets for planting. The reversed panels are attached to a structure necessary support structure that integrates with the envelope architectural envelope.

Fig. 6 - Right: The irrigation of this wall consisting of Reviwall® panels mounted
side by side, is done through a drip system composed of vertical collectors from which a series of horizontal tubes in plastic material for water distribution. This system also uses injection pumps controlled by control units and conductivity sensors to fertilize plants independently when necessary. The irrigation system of this vegetal wall is powered by a photovoltaic generator produced by SolarLine s.r.l.

(Source of images of Fig. 5 and 6: Luca Siragusa)



Wall

CONFINA Mobilane ®

Poliflor is an Italian company that produces and distributes systems. Since 2001, it has been committed to the development of its products also through its own research center that collaborates in the field of sector with other European partners (Helix GmbH - Stuttgart, Xeroflor - Bremen, Mobiliane - Netherlands).

Note

Company details

Poliflor s.r.l.
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48026 Faenza (RA)
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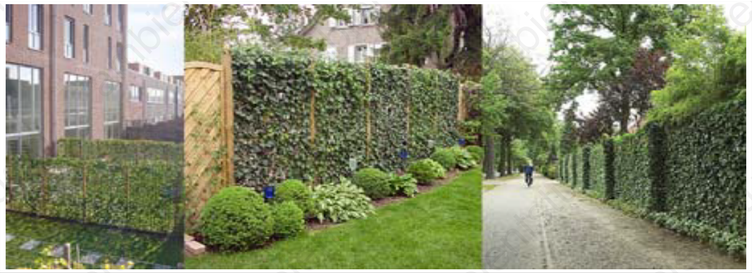
Phone +39 0546 44154
Fax +39 0546 44444
Website: www.poliflor.net
E-mail: info@poliflor.net



References

Product type

CONFINA Mobilane® is a plant barrier consisting of a wire mesh, covered with plants that grow in a biodegradable coconut fiber container filled with soil and placed at the foot of the grid itself.
Green walls of different sizes and models are available, covered with evergreen plant species such as Ivy (Hedera), Hornbeam (Carpinus), Beech (Fagus) and Rhyncospermum jasminoides, making it possible to create, if necessary, green barriers of different heights. This vegetal wall, in fact, can be adapted to non-standard sizes using cutters. To join the single elements of the wall the individual elements of the wall, metal or wooden poles can be used, both equipped with sturdy brackets.
This vegetal barrier allows to achieve an immediate green result, while ensuring privacy and security. It is particularly suitable to be used for the realization of vertical plant fences such as hedges, or green walls to delimit terraces and roof gardens. At the same time it could also be used as a coating of the walls of buildings to improve the microclimate of indoor environments and reduce energy consumption for cooling in summer.

Details

The data are taken from the company catalog of MACCAFERRI s.p.a.

Wall

Grid Panels

Il Ceppo s.r.l. is an Italian company that produces gazebos, pergolas, planters and wooden grating panels for the decoration of outdoor spaces. This company offers a full range of solutions that aim to integrate greenery into the external elements that surround the building, such as fences, railings and green curtains to delimit any porches.

Note

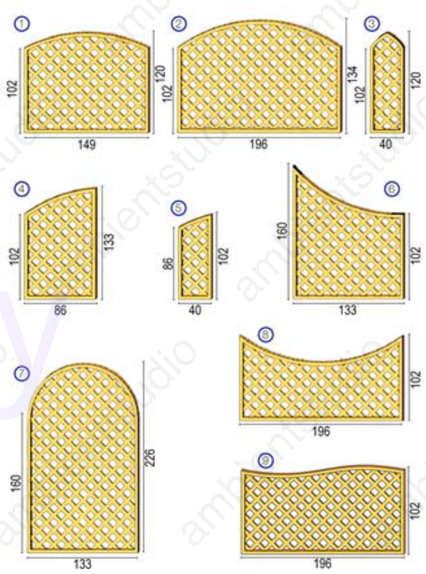
Company details

Il Ceppo s.r.l.
via Dell'Olma 12
42012 Campagnola Emilia (RE)
Italy
Phone +39 0522 652866
Fax +39 0522 652895
Web site: www.ilceppo.it
E-mail: ilceppo@ilceppo.it

References

Product type

The grating panels are a modular support system for climbing plants
to be used in the construction of green fences, sunscreens of a terrace or plant barriers to recreate outdoor spaces of privacy. Each panel consists of a pine or fir wood grating, available in different shapes and in various mesh configurations (square or diagonal mesh). At the foot of the panel can be directly on the ground of a lawn, in case it is to be built a fence, or a wooden container filled with soil for plant cultivation can be placed at the foot of the panel, in case you have to build a plant barrier. For their functions the grating panels are properly subjected to protective treatments in order to resist the aggression of atmospheric agents, microorganisms and insects. The treatments of wooden panels are carried out in an autoclave inside a large cylindrical container, where a vacuum condition is recreated in order to remove all the air inside the wood cells. Each panel is then impregnated at high pressure with a protective liquid, which fills the cylindrical container completely. This impregnating liquid is composed of ecological salts (free of arsenium and chromium-free salts certified by the Berlin Institute for Building Technology (DIBt). The last step in the process is to create a vacuum to remove excess protective liquid from the wood. As proof of the protective treatment with environmentally friendly products, each panel comes with a RAL mark, which gives the product a guarantee not only of environmental guarantee not only of environmental safety, but also of durability for at least ten years.



Details

The data are taken from the company catalog of MACCAFERRI s.p.a.

Wall

SEMIRAMIDE ®

CIR Ambiente, born in 1988, is a specialized company that realizes various types of acoustic barriers for the global solution problems related to noise in urban environment and in very busy roads. The company also provides studies on the environmental acoustic impact, phonometric surveys, design of optimal solutions, installation and testing.

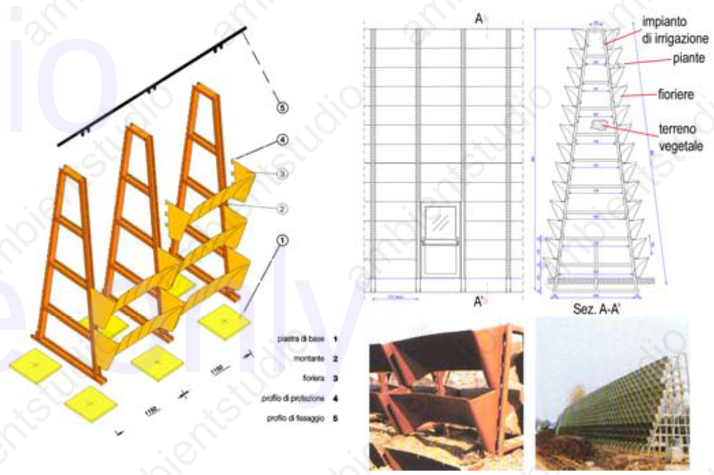
Note

Company details

References

Product type

SEMIRAMIDE is an acoustic barrier consisting of an embankment of earth covered with plant essences and supported by a structure made of galvanized steel, which is a non-polluting, stainless and recyclable material. The metal structure constitutes only 2% of the acoustic screen, which owes its efficiency to the large mass of earth "laid" and the plants that are grown there, as well as the concave shape of the planters. In addition, terraced cultivation and direct contact with the ground naturally bring the necessary humidity to the plants, which are irrigated by a system consisting of self-drip pipes with holes at a pitch of 300 mm. This vegetal barrier develops vertically with a minimum footprint and is suitable for both straight and curved paths. Its use is suitable for any type of terrain and slope, and it is possible to insert through the metal structure, also doors with function of "escape route". The modularity of the elements also allows the total disassembly or parts of the the integration with other types of acoustic screens. This vegetal barrier is suitable to isolate from noise very busy roads.



Details

Wall

Baerma System ®

Officine MACCAFERRI s.p.a. is an Italian company which designs advanced solutions in the fields of geotechnics and soil erosion control. This company is constantly engaged in research activities aimed at improving its know-how in order to guarantee the maximum level of innovation and efficiency in the development of its products.

Note

Company details

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Fax +39 051 236507
Website: www.maccaferri.com
E-mail: comit@maccaferri.com

References

Product type

The Baerma System is a vegetated wall of acoustic protection consisting of a metal structure, to which are attached the side walls of containment of soil of cultivation of plant essences. The metallic structure of this soundproof barrier is defined by a succession of galvanized steel uprights with a minimum profile thickness of 85 mm, which varies depending on the height of the work to be erected. The side walls of the wall are made up of panels of electro-welded mesh painted with a polyester coating and having a mesh of 100x200 mm, realized with a vertical galvanized wire of 6 mm in diameter and with a double horizontal galvanized wire of 8 mm diameter. The containment of the soil in the wall cage of this sound-absorbing barrier is guaranteed by the presence of a three-dimensional geomat adhering, on the internal face of the wall, to a bio-mat. The filling soil used is an artificial substrate composed of an inert matrix of sand and gravels not limestone, mixed with organic soil improvers (peat, etc..), synthetic fertilizers and slow release fertilizers and Ph. In relation to local climatic conditions and the plant species of cultivation, the substrate can be modified without decreasing the high infiltration capacity and an effective microporosity, which favor the permanence of water inside for the water needs of the plants. This sound-absorbing green wall is also equipped with a system of drip irrigation system, consisting of individual drip wings housed in the substrate.

Details

The data are taken from the company catalog of MACCAFERRI s.p.a.

Wall

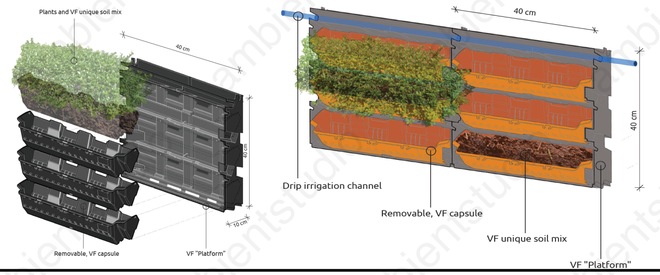
Vertical Field ®

Vertical Field is an agritech company that develops geoponic (soil-based) vertical growing solutions for the urban ecosystem. Our products, which include urban farms and active living walls, make efficient use of city space by growing plants and crops vertically, turning cities into hubs of healthy food, sustainability, and wellness.

Note

Company details

Hapnina 8, Raanana, Israel
+972-74-700-0911
info@verticalfield.com



References

Product type

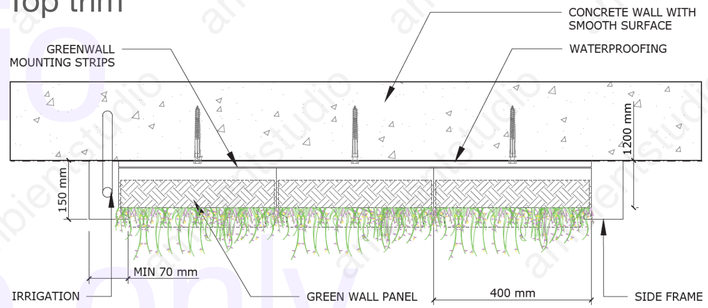
Concrete/block/ masonry Wall:
the wall must be prepared to be smooth and flat with sealant and a waterproofing layer.
- Dry wall/ Cement-board:
The metal studs must be built vertically from floor to ceiling at a distance not exceeding 40 cm from each other, starting from the first stud.
- Light metal construction:
The metal studs must be at a distance not exceeding 40 cm from each other, starting from the first stud.

Detailed guidelines for the amount and size of lines will be given depending on the size and location of the green wall.

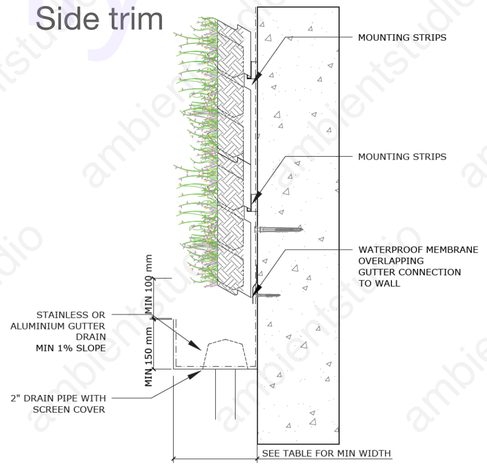
The data are taken from the company catalog of verticalfield

Details

Top trim



Side trim



Canevaflor ® plant wall

Vertical greening system of insulated elements

Fig. 8 - Top left: the plant wall Canevaflor®, produced by the French company Canevaflor, has been implemented in a park in Paris. The wall also offers also good insulation insulation and sound absorption.

Fig. 9 - Bottom left: the same vegetated wall isolated has been realized inside a square in the town of Montbeliard.

Fig. 10 - Right: the wall produced by Canevaflor consists of a modular structure cage in galvanized steel with the external surfaces closed by a mesh of the same material. Inside is placed the cultivation substrate composed of a mixture of organic and minerals. The plants can take root easily due to the great thickness of the substrate, whose minimum size is 20 cm, and its high capacity of water retention. The substrate is kept inside the metal structure containment by a canvas of non-woven fabric.

(Image source of Fig. 8, 9, and 10: www.canevaflor.com)

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Under certain circumstances, the copyright owner may be entitled to receive statutory damages, attorneys' fees and court costs from an infringer. Statutory damages means that the copyright owner does not have to prove the amount of actual damages it suffered as a result of the infringement. Instead, the court may award up to $150,000.00 per infringement. In other words, a builder might be liable to a copyright owner up to $150,000.00 for each structure that infringes the copyright owner's rights. In addition to statutory damages, the court may require the infringer to pay court costs and the copyright owner's attorneys' fees.

THE ORIGINAL ARCHITECT OR DESIGNER REMAINS THE OWNER OF ANY COPYRIGHTS IN THE ARCHITECTURAL DESIGN, EVEN IF THE CONTRACTOR OR OWNER PAID FOR THE DESIGN.

In many construction projects, the owner, construction manager or contractor will contract with an architect or designer to design the project. Regardless of payment, if the contract does not state otherwise, the original architect or designer retains ownership of the copyrights and the purchaser merely obtains a non-exclusive license to use the plans for that particular construction project. This means that the owner and/or contractor do not necessarily have the right to use the purchased plans for any other projects and do not have the right to prevent the original designer from selling those same plans to other owners and/or contractors. Accordingly, owners and/or contractors should insist that their design contracts contain a written assignment of all copyrights and other intellectual property that the architect or designer owns in the plans to ensure that the architect or designer does not retain any intellectual property rights in the design which could create issues down the road. Alternatively, an owner or contractor should obtain written permission from the original architect or designer before reusing previously-purchased plans on other projects. If the design's uniqueness is important to the owner, it should also insist that its license be exclusive. Otherwise, an architect could resell the design to others.

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