

Green & Blue Roof Systems



Guide to our complete green and
blue roofing solutions

GAF
We protect what matters most™

Meeting your needs: complete system solutions

Our market-leading brands cover every roofing technology, so we can recommend the best solution for our customers' needs.

Our philosophy is to look beyond just roofing products. Individually, our products offer exceptional performance. Working together, they offer unrivaled reliability and excellence.

That's why we are committed to developing complete and integrated systems which combine technologies, products, components and accessories with specialist support, services, training and guarantees.

We ensure a perfect alignment of form, function and performance.

Active roof solutions

At GAF, we believe a roof can offer so much more. From materials that absorb pollution, to roofs that double as gardens and living spaces — our active roof solutions are transforming urban spaces.

The possibilities are endless. We're here to help people find the perfect solution for their homes and workplaces.



Contents



Why choose a GAF green roof?	06
Benefits of a green roof	08
Types of green roof	10
Design considerations for a successful green roof	12
Green roof build-up	14
Technical specification	15
Combining green and blue roof	18
GAF blue roof solutions	19
Roof decks and stormwater management	20
Roof decks	22







Why choose a GAF Canopia green roof ?

At GAF, we believe a roof can offer so much more. From materials that absorb pollution, to roofs that double as gardens and living spaces — our active roof solutions are transforming urban spaces.

The possibilities are endless. We're here to help people find the perfect solution for their homes and workplaces.



The strength of a global partner

GAF builds its position on 160 years of experience in roofing and waterproofing. This demonstrates our commitment to provide waterproofing and green roof systems which can fully satisfy your project requirements.

Single source responsibility

GAF as a single source provider eliminates the significant risk of problems occurring over liability should faults occur in the waterproofing integrity.

Our multi-product portfolio includes reinforced bitumen systems, single-ply and solvent-free liquid applied waterproofing which allows us to specify without any bias the correct solution for the roof in question.

Commitment to sustainability

As a company, GAF is proud of its strong environmental credentials, actively promoting the recycling of its products whenever possible, in order to minimise the use of raw materials and energy in the development and production of roofing and waterproofing solutions.

This means that many of our products already meet and often exceed environmental standards, and are already recognised by many of the industry bodies promoting excellence in this field.

Technical expertise

The financial implication of inappropriate design, poor recommendation or substandard product and workmanship can be considerable and can impact on the long term performance of the building. The BMI Canopia approach to any roof is well proven over many thousands of successful projects and ensures success from the initial design and consultation to the guarantee sign off.



Benefits of a green roof

Improved air quality

Green roof planting will improve air quality by absorbing atmospheric carbon dioxide and releasing oxygen.

Roof membrane protection

Vegetation on a roof deck protects the roof surface from the extremes of weather, temperature and ultraviolet radiation, prolonging its life.

Wildlife habitats

Rooftop habitats can provide a 'green link' connecting natural pockets of habitat with each other. They can also provide isolated habitats, which aren't disturbed by other green areas at ground level.

Improved temperature regulation, heat island effect mitigation

Through the daily cycles of condensation and evaporation, plants are able to cool and humidify the surrounding air improving the micro-climate (thanks to the evapotranspiration of the plants).

Reduced storm-water run-off

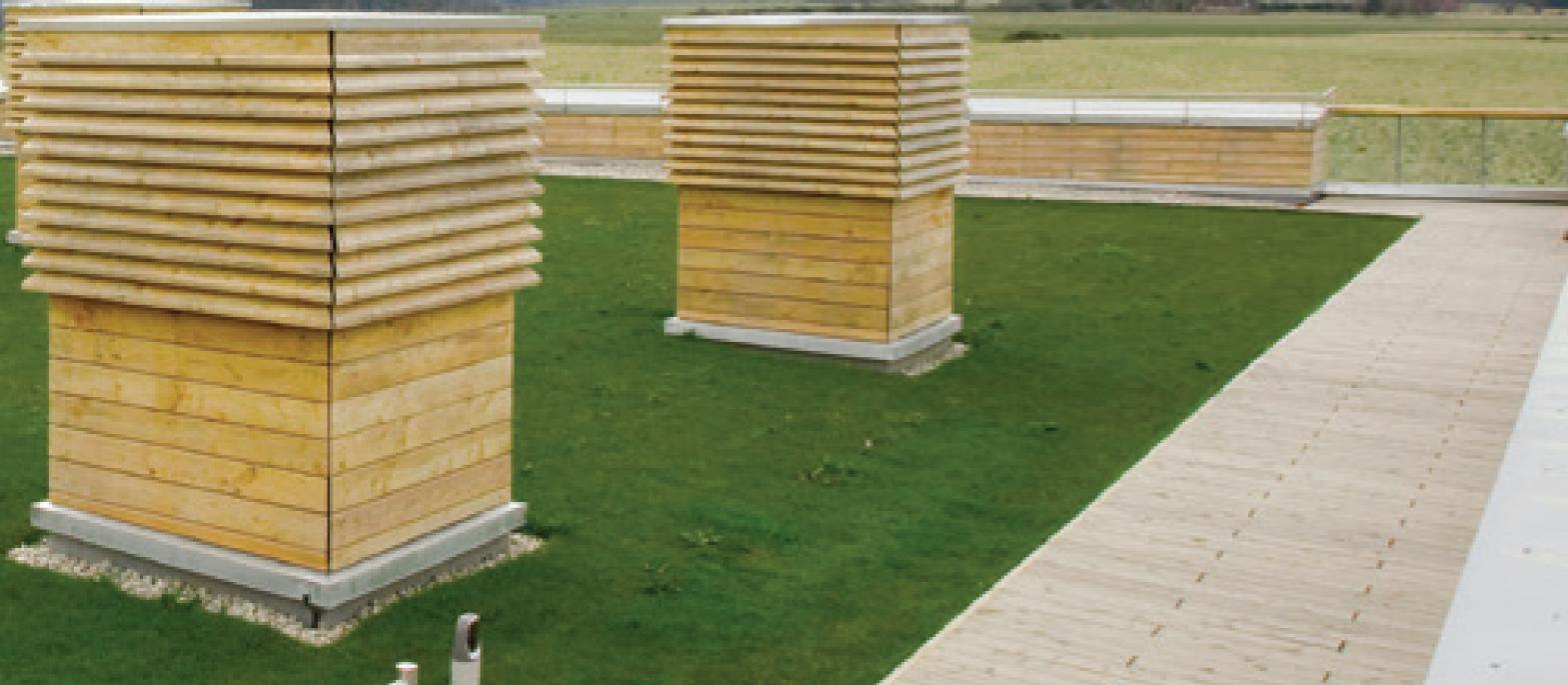
Water is stored by the green roof substrate and then taken up by the plants from where it is returned through transpiration and evaporation into the atmosphere. Green roofs also delay the time at which run-off occurs, resulting in decreased stress on drains and sewers at peak flow periods.

Reduced energy costs

The layers of a green roof system are able to improve the thermal performance of the roof, thereby reducing solar gain.

Attractive design opportunities

Urban greening has, for a long time, been seen as a way to make towns and cities look more pleasing to the eye and be of great value to the well being of building users.



Strengths & opportunities

Strengths

- Expansion of flat roof construction sector.
- Numerous advantages of green-roofs.
- Huge untapped market.
- Various financial benefits.

Opportunities

- Several initiatives taken by the government.
- Rapid industrialization.
- Increasing green-house effect and higher awareness for a change.

How can green roof be the solution for many problems in the cities?

Possible upcoming problems in the cities

- Increasing surface sealing within the cities.
- Reduction of green spaces in some urban areas.
- Loss of habitats for the local Flora and Fauna.
- Change of the urban climate due to construction activities and the climate change.
- Increase of heavy rain events and therefore danger of flooding, especially in highly sealed areas.
- Overload of existing canalization.
- Formation of urban heat islands.
- Increase of dust and pollutants in the air.



Ecological effect of a green roof

- Increase of green spaces and evaporation surfaces effects a cooling and moistening of the air.
→Reduction of local heat islands effects.
- Retention and evaporation of 50-90% of the precipitation on a roof area.
→Delayed introduction of rain water leads to an equalization of drain peaks.
→Minimizes the overload of the canalization.
→Minimizes the danger of flooding.
- Creation of new habitats for the local Flora and Fauna.
- Binding of dust and pollutants by the plants



Types of green roof

There are a number of different types of green roof, defined by the way they are used. The basic types of green roof fit into either extensive or intensive categories, but there are also those which are a hybrid of both - these types of systems could be termed semi-extensive or semi-intensive.

Intensive systems

These systems are designed to be accessible and used as recreational spaces, and often involve many features similar to traditional ground level gardens which can include paving, water features, lawns, shrubs and trees. These intensive 'roof gardens' are soil based multi layered systems and are so called because they are labor-intensive requiring higher levels of irrigation, feeding, and other maintenance compared to their extensive counterparts.



Extensive systems

Extensive green roof systems are generally intended to be viewed from another location as a decorative and ecological feature maximizing otherwise unused space for biodiversity or aesthetic appearance. They are not normally used as a recreational space to be walked through or sat in and often have limited access for maintenance only.





Extensive sedum roofs

The sedum family of flowering plants is widespread throughout the Northern Hemisphere, varying from annual and creeping herbs to shrubs. They are succulents and therefore have leaves which are able to store water, making them ideal for green roofing applications.

Extensive Biodiverse / Meadow Roofs

Biodiverse and meadow roofs are intended to generally provide a habitat to create a wider diversity of flora and fauna compared to a traditional sedum green roof. They are often designed to either re-create or even improve the habitat that was lost when the building was erected. These types of roofs can be constructed to provide the right conditions for specific plants which in turn support other insect and bird species. Often wildflowers, grasses and sedums are the main species of vegetation designed to thrive within such systems.



Brown Roofs

A brown roof is where the substrate surface is left to self-vegetate from windblown and bird lime seed dispersal. Brown roofs are the best way of replicating exactly the wild urban spaces that are found at ground level. They have become a popular type of roof garden finish in recent years as they are seen by many planners as a more natural, rugged urban feature and can offer a greater diversity of species as well as prolonged foraging for insects.



Wild Roofs

The idea is to design roofs which are first of all functional for the target species with mainly food resources (melliferous plants, dead wood, watering place, seeds, etc.) and refuges (sand for wild pollinator villages, stumps, nesting boxes, etc.). The creation of mounds provides refuge for invertebrates from extreme temperatures. Dead wood from trees felled creates habitats for stag beetles and other species.





Design considerations for a successful green roof

Key elements for design

A flourishing green roof requires

- Suitable amounts of sunlight, water, sufficient drainage and aeration to encourage healthy plant growth.

To deliver a successful green roof the designer must consider:

- The building's position and location, along with the orientation of the roof during the day and any shade from surrounding buildings.
- The roof's height can have an effect due to wind action and can cause wind scour of the substrate. Pebble borders are generally used to avoid this.

- The additional weight loading from a green roof is a major factor to consider as the structure must have sufficient load bearing capacity to support a water saturated green roof system.

- The roof must have sufficient drainage which will prevent excessive saturation of the growing substrate which can lead to deterioration of the planting and will help reducing the imposed loads.

- A green roof will require regular safe access for maintenance, and it is important that adequate fall protection measures are put in place to allow for safe inspection and maintenance of the roof.



Don't forget water

Green roofs will require water and provision for irrigation should be considered at the planning stage. All Green roofs will require irrigation during the establishment period and so a water source should be provided.

Intensive roof planting and lawns will require a permanent irrigation system to keep them supplied with water during hotter, drier, summer months.

Extensive roofs will only need irrigating during the establishment phase, and very little subsequently except during longer periods of drought.*

Pitched roofs retain less water and therefore a permanent irrigation system should be considered.

*depending the geography and choice of vegetation

Product & technical data	Intensive systems	Extensive systems
Usage	Generally as a recreation space	Generally for visual / environmental / biodiversity
Landscaping	Trees, shrubs, lawn turf, hard landscaping	Sedums, wildflowers, grasses, mosses
Maintenance	Regular maintenance required	Minimal requirement
Irrigation	Regular irrigation required. Usually dedicated systems installed	Only generally required during the establishment phase, or times of prolonged drought conditions.
Build-up depth	Typically around 200-1000 mm	Typically around 80-200 mm
System weights	Typically 150-1000 kg/m ²	Typically 100-180 kg/m ²
Roof slopes	Less suited to sloped roofs	Suitable for flat or pitched roofs (with suitable retension systems in place)
Water requirements	Greater water attenuation due to deeper substrate depths and types of plants	Less water required due to shallower substrate depths and sedums plants

In view of innovation, the specifications are subject to change without any prior notice and in the event of such changes, GAF shall ensure that the new specifications are equivalent if not better.

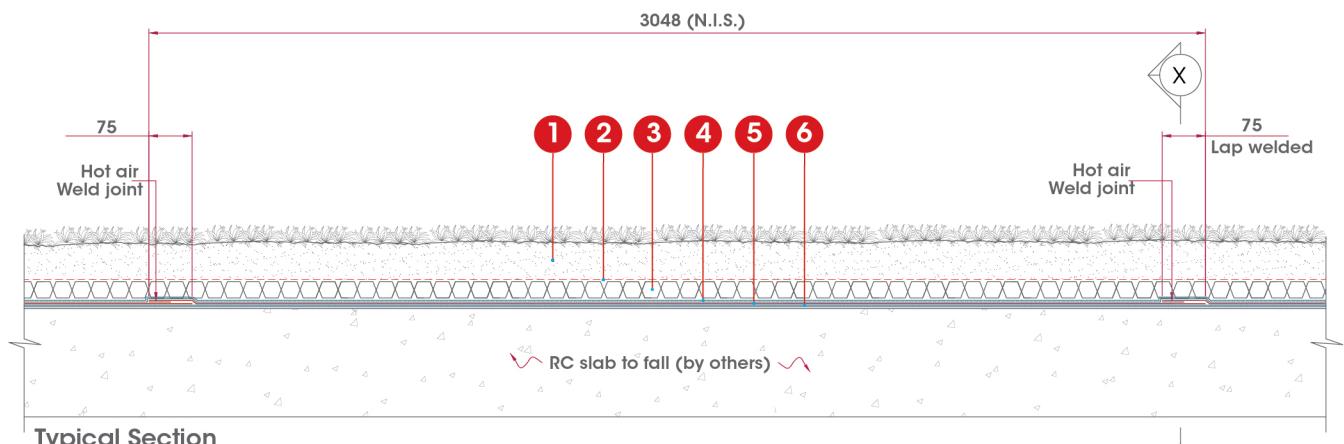


Green roof build up

	Intensive systems	Extensive systems
GAF Canopia	Perennials, grasses, summer flowers and shrubs, flowers bulbs, trees, lawns	Sedums, succulents, moss, herbaceous plants
Substrate	> 20-30 cm*	6-12 cm
Weight	> 400 kg/m ²	80-150 kg/m ²
Accessibility	Accessible to pedestrians	Not accessible
Deck	Concrete only	Concrete, steel (attention to load)
Cost and maintenance	High	Very low

* Can vary according countries

In view of innovation, the specifications are subject to change without any prior notice and in the event of such changes, GAF shall ensure that the new specifications are equivalent if not better.



- ① Soil & Plant
- ② 1 Layer of filtration fleece
- ③ 1 Layer of drainage cell
- ④ 1 Layer of GAF geotextile 300 gsm

- ⑤ 1 Layer of 1.52mm THK. GAF Everguard TPO Extreme membrane loosely laid
- ⑥ 1 Layer of GAF geotextile 300 gsm

Technical specification

Extreme® TPO 50 mil membrane

Applicable Standards

UL Listed, FM Approved, ASTM D6878, Title 24 Compliant, Miami-Dade County Approved, Florida Building Code Approved, ENERGY STAR® Qualified.*

Physical Properties	ASTM Test Method	ASTM D6878 Minimum	EverGuard Extreme Typical Test Data
1. Certain data is provided in MD (machine direction) x CMD (cross machine direction) format. 2. Data is based upon typical product performance, and is subject to normal manufacturing tolerance and variance.			
Nominal Thickness			
Nominal Thickness	ASTM D751	0.039" (min.) (0.99 mm)	0.050" (1.27 mm)
Breaking Strength	ASTM D751 Grab Method	220 lbf/in. (38.5 kn/m)	305 lbf x 290 lbf (454 x 432.1 kg/m)
Factory Seam Strength	ASTM D751	66 lbf (98.34 kg/m)	150 lbf (223.5 kg/m) (membrane failure)
Elongation at Break	ASTM D751	15%	30%
Heat Aging	ASTM D573	90% Retention of Breaking Strength and Elongation at Break	100%
Tear Strength	ASTM D751 8" x 8" (203 x 203 mm) Sample	55 lbf (81.95 kg/m)	70 lbf x 110 lbf (104.3 x 163.9 kg/m)
Puncture Resistance	FTM 101C Method 2031	Not Established	380 (172 kg)
Cold Brittleness	ASTM D2137	-40°C	-40°C
Permeance	ASTM E96	Not Established	0.08 Perms
Dimensional Change	ASTM D1204 @158°F (70°C), 6 hrs.	+/-1%	0.4%
Water Absorption	ASTM D471 @158°F (70°C), 1 week	+/-3.0% (top coating only)	0.7%
Hydrostatic Resistance	ASTM D751 Method D	Not Established	430 psi
Ozone Resistance	ASTM D1149	No visible deterioration @ 7 x magnification	No visible deterioration @ 7 x magnification
Reflectivity (white) Initial/Aged	ASTM C1549	N/A	0.835/0.72
Emissivity (white) Initial/Aged	ASTM C1371	N/A	0.84/0.91
Weather Resistance	ASTM G155/D6878	10,080 KJ/(m ² . nm) at 340 nm	>46,000 KJ/(m ² . nm) at 340 nm
Heat Aging	ASTM D573	240°F (115°C) for 32 weeks	128 weeks
Thickness Above Scrim	ASTM D7635	Min 30% of Total Thickness	17.9 mil (Nominal)
Up to 25 years			

*ENERGY STAR® only valid in the USA

In view of innovation, the specifications are subject to change without any prior notice and in the event of such changes, GAF shall ensure that the new specifications are equivalent if not better.



Product information

Roll Size Note: Product sizes, dimensions, and widths are nominal values and are subject to normal manufacturing/packaging tolerance and variation.

Colors	Full Size Roll	Full Roll Weight	Half Roll Size	Half Roll Weight
White	10' x 100' (3.05 x 30.5 m) (1,000 sq. ft. [92.9 sq.m])	271 lbs. (123 kg)	5' x 100' (1.52 x 30.5 m) (500 sq. ft. [46.5 sq.m])	136 lbs. (61.7 kg)
	8' x 100' (2.44 x 30.5 m) (800 sq. ft. [74.3 sq.m])	217 lbs. (98.4 kg)	4' x 100' (1.21 x 30.5 m) (400 sq. ft. [37.1 sq.m])	108 lbs. (49 kg)

Note: Membrane rolls shipped horizontally on pallets, stacked pyramid-style and banded.

Storage Store rolls on their sides on pallets or shelving in a dry area.

Safety Warning Membrane rolls are heavy. Position and install by at least two people.

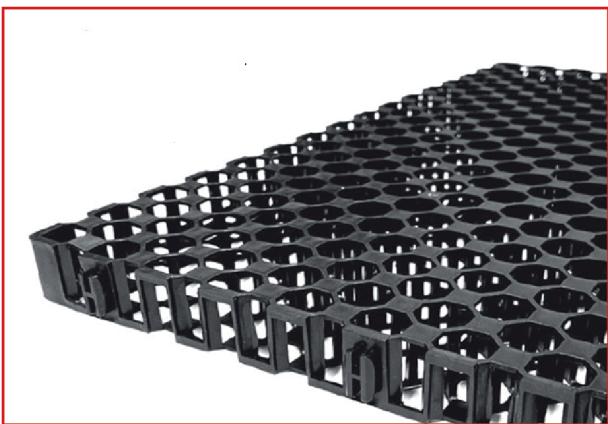


**GAF Evergurd Extreme®
TPO 50 mil membrane**

Drainage Cell® 30mm

PRODUCT & TECHNICAL DATA

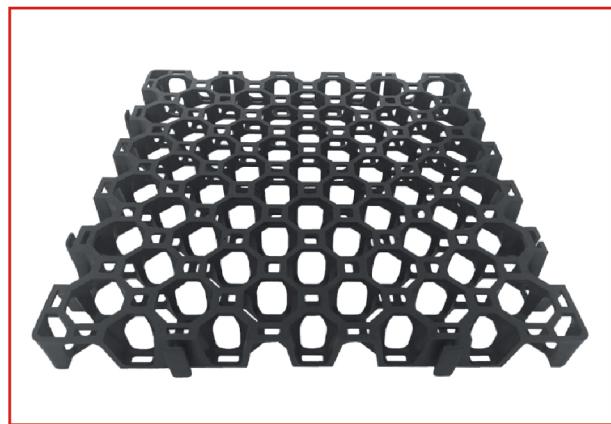
Height (mm)	30
Width (mm)	500
Length (mm)	500
Weight (kg/m²)	+ - 2.6
Discharge capacity @ 1% gradient (L/M/S)	16.5
Surface void area	65%
Material	100% Recycled PP
UV Stabilised	Yes
OCTO Drainage Cells® per m²	4
Compression strength (tones/m²)	>80 - 100
Internal void area	95%
Colour	Black



Drainage Cell® 50mm (Grass Cell®)

PRODUCT & TECHNICAL DATA

Height (mm)	50
Width (mm)	500
Length (mm)	500
Weight (kg/m²)	+ 6
Surface void area	>90%
Material	100% Recycled PP
UV Stabilised	Yes
OCTO Grass Cells® per m²	4
Compression strength (tones/m²)	>200
Internal void area	>95%
Colour	Black



In view of innovation, the specifications are subject to change without any prior notice and in the event of such changes, GAF shall ensure that the new specifications are equivalent if not better.

Filtration layer 150gsm specification

Product & technical data			
Raw Material	Test Method	Unit	UV-Stabilized Polypropylene
Mass per unit area	EN ISO 9864	g/m ²	≥ 150
Thickness	EN ISO 9863-1	mm	≥ 1.5
Tensile strength, md / cmd** (1)	EN ISO 10319	kN/m	11.0 / 12.0
Tensile elongation, md / cmd** (1)	EN ISO 10319	%	50 / 50
Water permeability (4) -V _{H50} - Index -Flow rate _{H50}	EN ISO 11058	m/s l/(m ² s)	1.0 x 10 ⁻¹ 100

Filtration layer 300gsm specification

Product & technical data			
Raw Material	Test Method	Unit	UV-Stabilized Polypropylene
Mass per unit area	EN ISO 9864	g/m ²	≥ 300
Thickness	EN ISO 9863-1	mm	≥ 3.0
Tensile strength, md / cmd** (1)	EN ISO 10319	kN/m	25.0 / 25.0
Tensile elongation, md / cmd** (1)	EN ISO 10319	%	50 / 50
Water permeability (4) -V _{H50} - Index -Flow rate _{H50}	EN ISO 11058	m/s l/(m ² s)	6.5 x 10 ⁻² 65





Combining green and blue roof

Rainwater management

Due to impermeabilization of surface areas in cities, only 15% of rainwater is infiltrated into the soil, 55% run off. During storms or heavy rain events, the urban draining network is often overflowed.

Green roof substrates act like a sponge but only to the limit of their capacities (mainly driven by the height of the substrate). By adding an extra component to the system, you can increase the water storage capacity, and reduce the amount of substrate on the roof.

You can also design your system in order not to release the water immediately, but keeping it for the plants, thus reducing the needs for watering and favorising evapotranspiration, and the fight against Heat Island effect. All type of vegetation can be applied onto the water storage component.





GAF Blue Roof Solutions

The GAF Blue Roof Systems are designed to explicitly store rainwater over a period of time, with each system designed specifically for each project.

Benefits of a blue roof

There are many benefits of a blue roof, depending on design:

- Temporary storage of rainfall to mitigate run-off impacts;
- Reducing flow rate of the roof;
- Storage of water for reuse, such as irrigation; and
- Make up the drainage and support layer for green roofs.

Technical expertise

Our Technical Advisors can assist with the design, specification and supporting calculations required for a GAF Blue Roof system or hybrid system in conjunction with a Canopia Green Roof. Combining extensive roofing and waterproofing knowledge and expertise with sustainability, water management and attenuation recommendations.

The GAF approach to any roof is well proven over many thousands of successful projects and ensures success from the initial design and consultation to project sign-off.

Single source responsibility

GAF as a single source provider eliminates the significant risk of problems occurring over liability should the integrity of the waterproofing be comprised.

Our multi-product portfolio includes reinforced bitumen systems, single-ply and solvent-free liquid applied waterproofing which allows us to specify without any bias the correct solution for the roof in question.



Roof decks and stormwater management

BMI RAINWATER STORAGE SOLUTIONS

The implementation of the Drainage cell and filtration layer

- BMI plates available from 30mm – 50mm /100mm (double stack) in depth
- Also available in tank module upon request



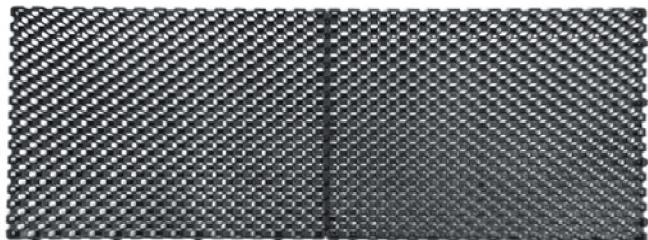


Advantages

- Light weight
- High compressive strength and durable
- Cost effective
- Efficient sub-soil drainage
- Multiple applications - for sports fields, civil works, retaining wall, bio-filtration, groundwater recharges, general landscape applications.

Application areas

■ Roof garden	■ Landscaped deck
■ Planter box	■ Retaining / basement wall
■ Playground	■ Bridge abutments
■ Sports field	■ Tunnel and landfills
■ Paved area and roadway	■ Golf course
■ Pond filter system	



Male joint



Female joint



Assembly indicator lines

Drainage cell specification

Product & technical data

Height (mm)	50
Width (mm)	500
Length (mm)	500
Weight (kg/m ²)	+- 6
Surface void area	>90%
Material	100% Recycled PP
UV Stabilised	Yes
Compression strength (tones/m ²)	>200
Internal void area	>95%
Colour	Black



Roof decks

Stormwater management

By utilizing the Canopia system with water management we can achieve the following:

- Fight against heat island effect
- Durability of waterproofing
- X 2 Living environment
- Thermal inertia Biodiversity ...

Vegetation :



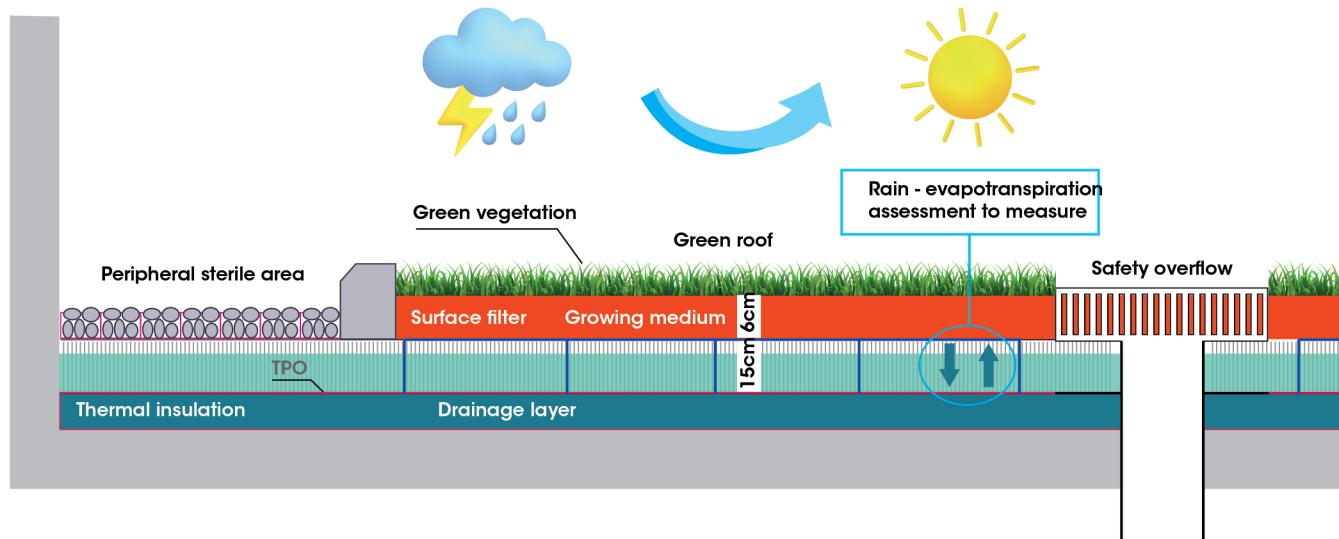
Extensive and semi-intensive



Jardin Traditional



Urban Vegetable Garden







BMI ROOFING SYSTEMS SDN. BHD. (BRSSB) reserved the right to change the contents of this document without any prior notice. Printed: 1/2025 © BRSSB

BMI ROOFING SYSTEMS SDN. BHD.

Registration No.197401002179 (19163-M)
(Formerly known as Monier Malaysia Sdn. Bhd.)
Suite 11.02, 11th Floor, Menara JKG,
No. 282, Jalan Raja Laut, 50350 Kuala Lumpur, Malaysia
T (+60) (3) 21760600 Toll Free: 1800 88 0865
roofing-malaysia@bmigroup.com

bmigroup.com/my



Scan QR Code for
Showroom & Sales
office location



A **standard** INDUSTRIES COMPANY

We protect what matters most™

