PLANNING GUIDE

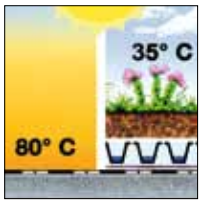
System Solutions for Intensive Green Roofs

Life on Roofs

Green Oases for Our Cityscapes

Advantages of green roofs regarding environment, urban development and construction:

Protection of the Roof Membrane



- Protects the roof membrane from UV radiation, heat, cold and hail

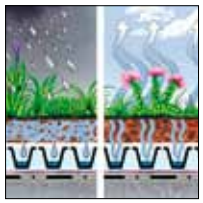
New Habitat

- Avoids sealing and creates new habitat for plants and animals

Utilized Roof Areas

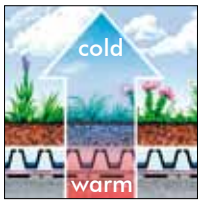
- Additional space for improved quality of life

Rainwater Retention



- Reduces run-off

Reduction of Energy Costs



- Thermal protection and reduction in heating and cooling costs

Noise Protection

- Enhances sound insulation

Features

Unlike extensive green roofs, intensive green roofs offer almost endless possibilities of design. However depending on the kind of vegetation intensive green roofs require more maintenance.

The features at a glance:

- **Maintenance**:
  - Medium to high level of maintenance
  - Periodic to regular irrigation
- **Plant communities**:
  - Herbs, grasses, perennials, lawn, shrubs, bushes and trees
- **Loads and build-up heights**:
  - Build-up height from 150 to 800 mm
  - Weight from 160 to 1200 kg/m²
- **Costs**:
  - Higher costs

Principles

At ZinCo, intensive green roofs are installed in accordance with standards and with system.

Our six principles at a glance:

- The System Build-up is tailored to suit each roof.
- The System Build-up ensures permanent drainage, even under load.
- The System Build-up provides for a good water/air balance.
- The System Build-up is adapted to suit the required type of vegetation.
- The System Build-up keeps maintenance and upkeep to a minimum.
- The System Build-up provides for a long green roof life.

More Options with ZinCo

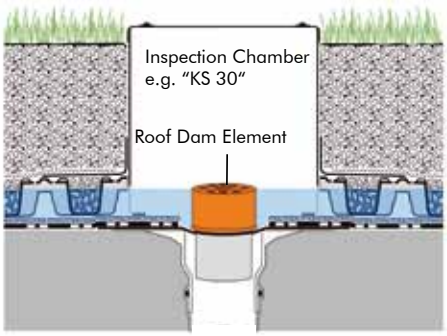
System Build-up “Roof Garden”

“Intensive green roof” with endless possibilities for design and use

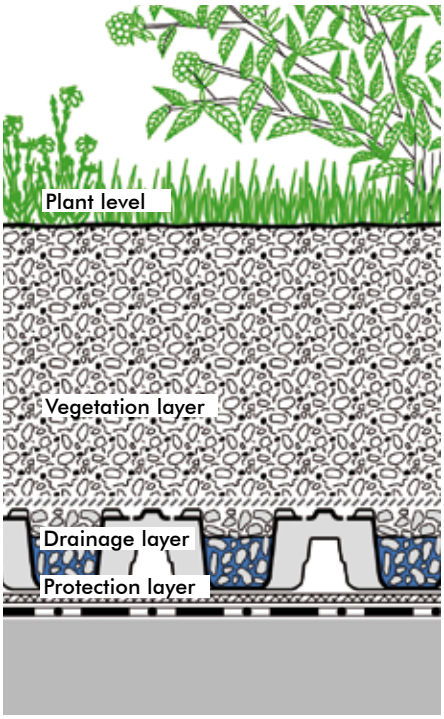
“Roof Garden” is a multifunctional green roof build-up system with a high water storage capacity, suitable for lawns, perennials, and, with a deeper substrate, for shrubs and even trees. In can be used in combination, for example, for walkways, terraces, driveways and play areas.
The Floradrain® FD 60 neo element, the heart of this green roof system, can be concreted as a base for the driveway or for foundations, without penetrating the waterproofing or impacting drainage.
With roof gardens, it is important to retain as much stormwater as possible in order to minimize irrigation works. The underlying channel system with Floradrain® FD 60 neo allows for a dam-up of up to 50 mm.

This is achieved by means of a roof dam element above the roof outlet on zero-pitch roofs (see below).

The water reaches the plants by capillary action and diffusion.
During dry periods, a minimum level of water can be retained.



Weight kg/m²		Height mm
dry	water-saturated	
from 200	from 300	from 200
32	68	70
232	368	



Lawn, perennial plants, and with deeper substrate, also shrubs and small trees

System Substrate “Roof Garden”
or System Substrate “Lawn”

Filter Sheet SF

Floradrain® FD 60 neo filled with Zincolit® Plus

Protection Mat ISM 50

Root Barrier WSB 100-PO,
if waterproofing is not root-resistant

Build-up height:	from 270 mm
Weight, saturated:	from 370 kg/m²
Water retention capacity:	from 136 l/m²

Floradrain® FD 60, used for millions of square metres, has been further developed and now, as **Floradrain® FD 60 neo**, provides even more options.

European Technical Assessment
"Kits for Green Roofs"
CE ETA-13/0668

System Build-ups with European Technical Assessment. Details at www.zinco-greenroof.co.uk

System Build-up “Roof Garden” with Aquatec® AT 45

Light-weight “Intensive Green Roof” with patented underfloor irrigation

Up to now, light-weight solutions were only possible in the field of extensive green roofs. However, with the System Build-up “Roof Garden“ with Aquatec® AT 45 the balancing act between “light-weight“ and “intensive“ can easily be mastered. It allows for visually appealing prestigious designs even on roofs with a low load bearing capacity.

The drainage element Aquatec® AT 45 and the Wicking Mat DV 40 are the heart of this build-up. The basic principle involves the distribution and storage of water in the element cells which is then drawn upwards when required, through the wicks in the mat to the substrate layer. The water is fed through special dripperlines and the amount is controlled by the specially-developed electronic Irrigation Manager BM 4.

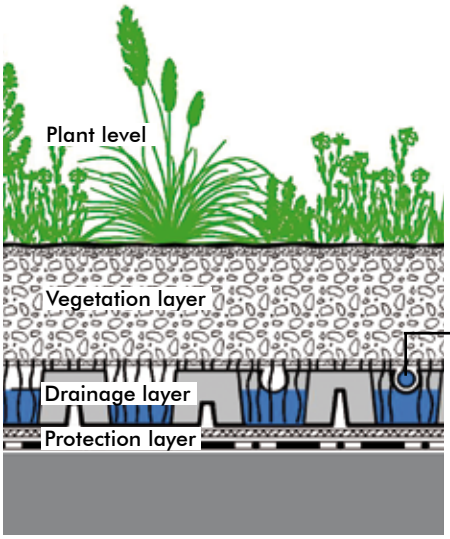
Water consumption is significantly lower with this type of irrigation than is the case with irrigation from above, as the water is available directly in the root area and there is considerably less evaporation.

Due to this sophisticated kind of irrigation substrate depths can be reduced up to 50 % in comparison to other intensive build-ups which results in a lower system weight. Furthermore the Aquatec® elements do not require an infill as some other build-ups which also contributes to reduction in material requirements, installation costs and weight.

One greening variation is the herb-turf roll, for example, which was specially developed for this build-up. Depending on cutting frequency, it can be used either as a lawn for access or as a herb meadow.

Weight kg/m²		Height mm
dry	water-saturated	
116 – 140	155 – 210	100–150*
4	25	50
120 – 144	180 – 235	

* >150 mm System Substrate “Lawn”



Lawn, perennial plants, and with deeper substrate, also shrubs and small trees

Zincohum

System Substrate “Sedum Carpet”,
Dripperline 100-L1
Wicking Mat DV 40
Aquatec® AT 45
Filter Sheet PV
Root Barrier WSB 100-PO,
if waterproofing is not root-resistant

Build-up height:	from 150 mm
Weight, saturated:	from 180 kg/m²
Water retention capacity:	from 60 l/m²

Slotting the dripperlines into place. The lines are then connected to the control system.

When installed, the wicks in the Wicking Mat dip into the cells and carry the water to the substrate.

Perfectly implemented technology allows for lots of variety with an intensive green roof.

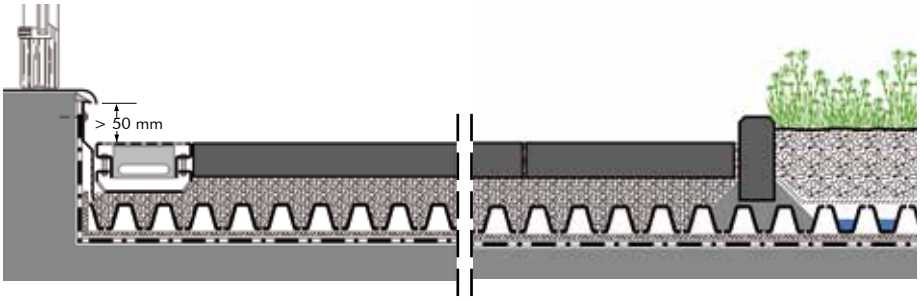
System Build-up “Heather with Lavender”

Visually appealing “Simple Intensive Green Roof” with reduced maintenance.

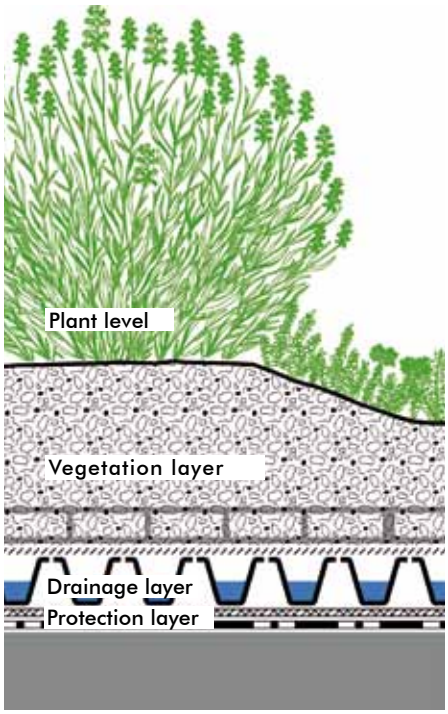
The plant community can be chosen amongst a wide variety of drought resistant perennials, grasses and low shrubs, for example thyme, origanum or lavender.

The relevant “Heather with Lavender“ System Substrate, which has been specifically designed for the plant community “Heather with Lavender“, in combination with the water retention and drainage element type Floradrain® FD 40-E creates the necessary habitat conditions so that the “Heather with Lavender“ – once rooted – requires little maintenance.

Floradrain® FD 40-E is ideal as a substructure for green roofs, but it can be applied just as well under concrete slabs or paved surfaces. Moreover, borders between different areas can be founded in a stable and secure manner. Kerbs can be set directly in concrete or mortar onto the Floradrain® without impeding the water run off.
Floradrain® also safely drains the excess water out of the channels or grills, which are often installed to safeguard door sills. In this case, the required upstand height which is normally 150 mm, according to the German Flat Roof Guidelines, can be reduced to 50 mm above the finished surface.
Beneath the paving stones, the Floradrain® elements are installed with the diffusion openings facing downwards and the troughs filled with stone chippings.



Weight kg/m²		Height mm
dry	water-saturated	
100 – 150	150 – 225	ab 100
3	11	40
103 – 153	161 – 236	



Build-up height: from 140 mm
Weight, saturated: from 160 kg/m²
Water retention capacity: from 60 l/m²

Plants according to plant list
"semi intensive – Heather with Lavender"

System Substrate "Heather with Lavender",
from 100 mm
Fallnet®
Filter Sheet SF
Floradrain® FD 40-E
Protection Mat SSM 45
Root Barrier WSF 40,
if waterproofing is not root-resistant

European Technical Assessment
"Kits for Green Roofs"
CE ETA-13/0668

System Build-ups with European Technical Assessment. Details at www.zinco-greenroof.co.uk

System Build-up “Underground Garage”

“Intensive Green Roof” with a highly resilient and driveable drainage layer

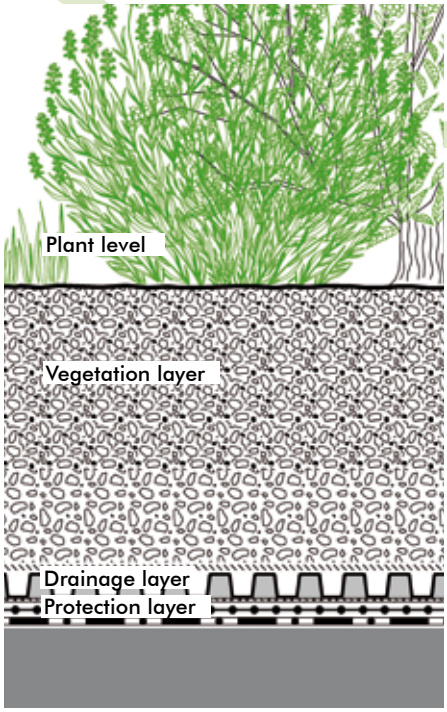
Due to the accessibility of underground car park decks and their normally generous structural load reserves, they provide a good opportunity for using a build-up where the substrate can be applied using a wheel loader.

In the System Build-up “Underground Garage”, the Protectodrain® or Elastodrain® studded sheets that cover the entire area, protect the roof membrane from all types of dynamic forces, even during the building phase. Covered with the stable filter sheet TG or PV, they also allow for excess water to safely drain off.

Together with Zincolit® Plus and the System Substrates, the build-up offers the widest possible range of solutions for planting and design.
Frequently, green areas are installed on underground car park decks in conjunction with different types of pathways or vehicle surfaces. Whether it’s a car space or a fire station entrance, grass pavers, block paving or concrete slabs – there are many options.

For further details, please see our ZinCo Planning Guide *“Walkways and Driveways“*. Simply request our catalogue or download it from *www.zinco-greenroof.co.uk*

Weight kg/m²		Height mm
dry	water-saturated	
from 200	from 300	from 200
depending on the total substrate depth		
5	5	30
205	305	



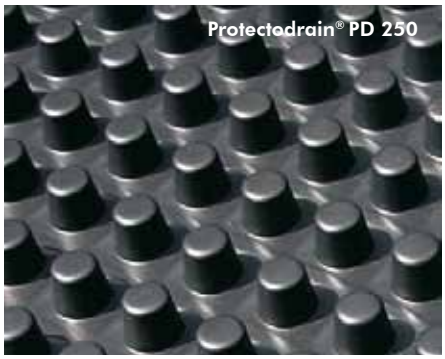
Lawn, perennials and with deeper substrate layers also shrubs and small trees

System Substrate "Roof Garden" or "Lawn"

Zincolit® Plus, in case of substrate depths ≥ 350 mm

Filter Sheet TG
Protectodrain® PD 250
Slip Sheet TGF 20
Root Barrier WSB 100-PO,
if waterproofing is not root-resistant

Even at the construction stage, a reliable protective layer is vital for the waterproofing membrane.

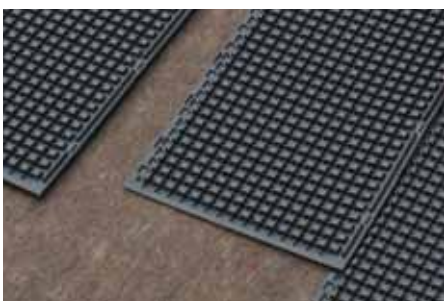


Protectodrain® PD 250 and particularly Elastodrain® EL 202 with its dense studding are ideal sub-structures for all types of pathway and vehicle surface.

System Build-up “Walk- and Driveways”

Stabilodrain® SD 30 boards have been installed all-over the underground garage.

Walkways and driveways in particular require well-engineered solutions that will ensure the proper functioning of the roof features (e.g. protecting the waterproofing, drainage, thermal and sound insulation). Beneath the surface, they absorb the horizontal forces generated by accelerating, braking and steering.
When combining walkways or driveways with a green roof, it is not only the drainage and compressive strength that are important but also the water retention capacity.
Stabilodrain® SD 30, the heart of this system build-up, meets all requirements and provides for permanent functionality. Stabilodrain® SD 30 is a highly stable and pressure-resistant drainage element that is quick and easy to install. It allows for water drainage and, depending on how it has been installed, for additional water storage. Stabilodrain® SD 30 can be used on inverted roofs without impacting the vapour diffusion above the XPS insulating material.
For more details, please see the ZinCo Planning Guide “Walkways and Driveways on Roofs”.
The guide can be requested or downloaded at ***www.zinco-greenroof.co.uk***



Special connector studs along the long side allow for the Stabilodrain® SD 30 elements to be fitted in a lattice structure.

The volume of Stabilodrain® SD 30 between the studs with the studs facing upwards is approx. 20 l/m².

Standard practice: Delivery traffic on over-basement pedestrian areas such as here in Duesseldorf, KÖ-Bogen.

Example of "Inverted Roof" Build-up

Lawn, perennials, with deeper substrate layers also shrubs and small trees

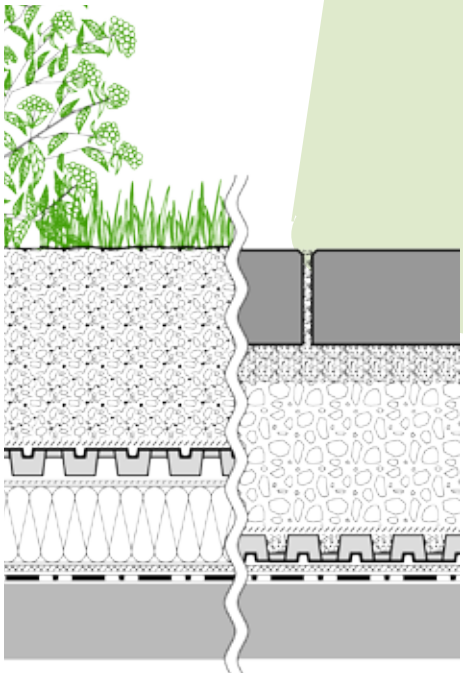
System Substrate "Roof Garden"

Filter Sheet TG
Stabilodrain® SD 30
Separation Membrane TGV 21
XPS Thermal insulation
If waterproofing is not root resistant the Root Barrier WSB 100-PO is required additionally (to be laid directly on the waterproofing)!

Height mm

≥ 200

30



Example of "Non-Insulated Concrete Roof"

Height mm

≥100 Heavy duty paving slabs

Bedding layer of stone chippings

≥150 Gravel base layer

Filter Sheet PV

30 Stabilodrain® SD 30, filled with stone chippings

Filter Sheet PV

Installation beneath the greenery is with the studs facing downwards, the water retention capacity is then approx. 7.5 l/m².

Roof Garden	
Weight, saturated:	from ca. 310 kg/m²
Water storage capacity:	from ca.100 l/m²
Driveway:	from ca. 600 kg/m²

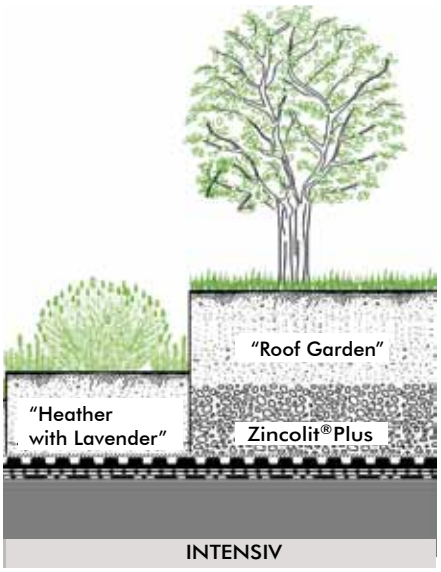
Stabilodrain® SD 30 is installed beneath walkways and driveways with the studs facing upwards.

Substrate Properties and Depths at a Glance

The different requirements of a roof substrate depend on the various vegetation needs. Water storage and nutrient supply are particularly important for intensive green roofs with sophisticated perennials and shrubs. In the case of intensive substrates (system substrate "Heather with Lavender" or "Roof Garden"), finer granulation is combined with a greater level of organic matter.
This ensures that the plants are supplied with the appropriate level of water, without reducing the air volume in the substrate that is required by the plant roots. In addition to choosing the correct substrate for the relevant vegetation, the substrate depth is of vital importance for the success of the green roof.

See diagram below for recommended depths. It is possible to apply more substrate than specified below. This can be particularly useful when planting a combination of trees, perennials and grasses.

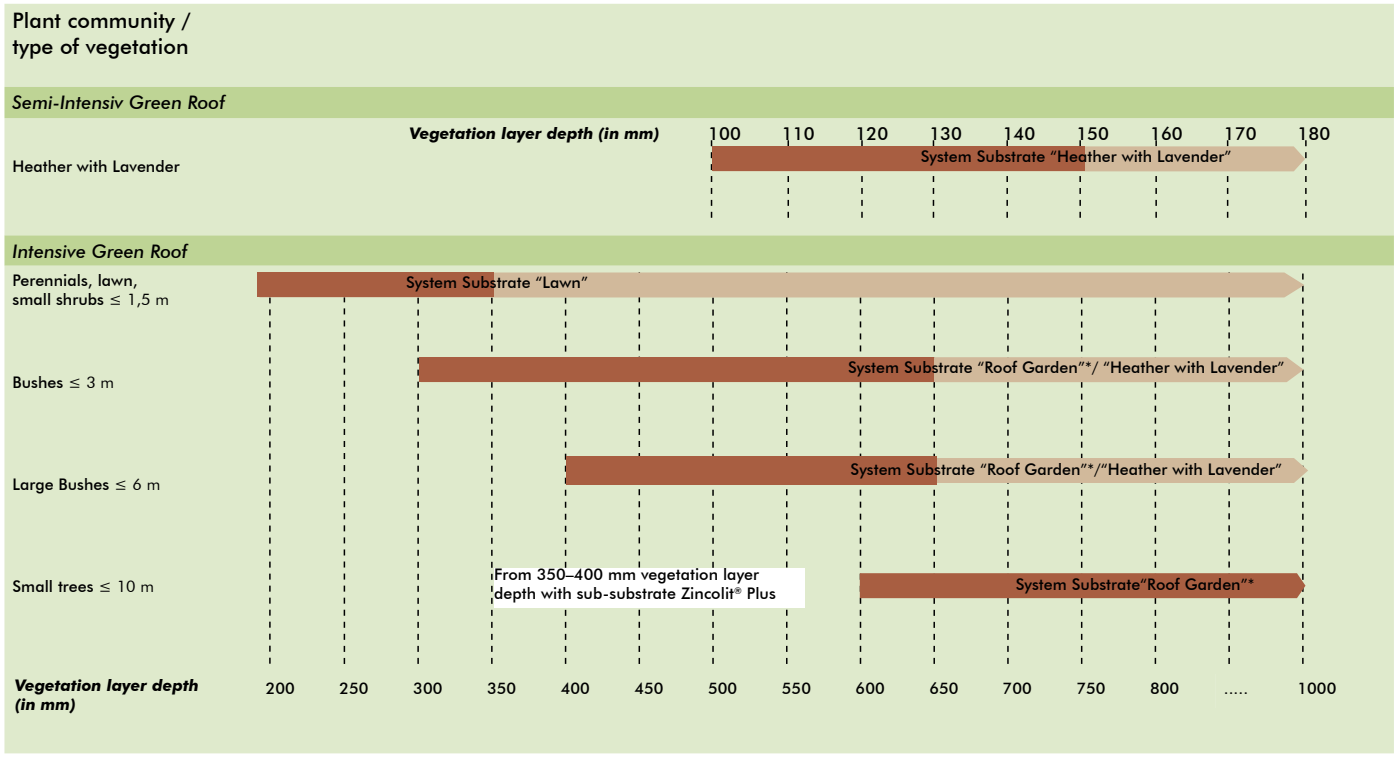
Alternatively, mounds can be created in certain zones. From a height of 35–40 cm upwards, the vegetation layer consists of an upper substrate and a sub-substrate, Zincolit® Plus, for structural stability and enhanced ventilation.



The "substrate bar" in the diagram below shows the minimum height from which the planned vegetation can be established.

The values apply to average precipitation levels from 700 mm upwards.
The vegetation layer should be slightly increased if precipitation is lower. The dark sections show a suitable range for the vegetation layer depth.

Depth of vegetation layer

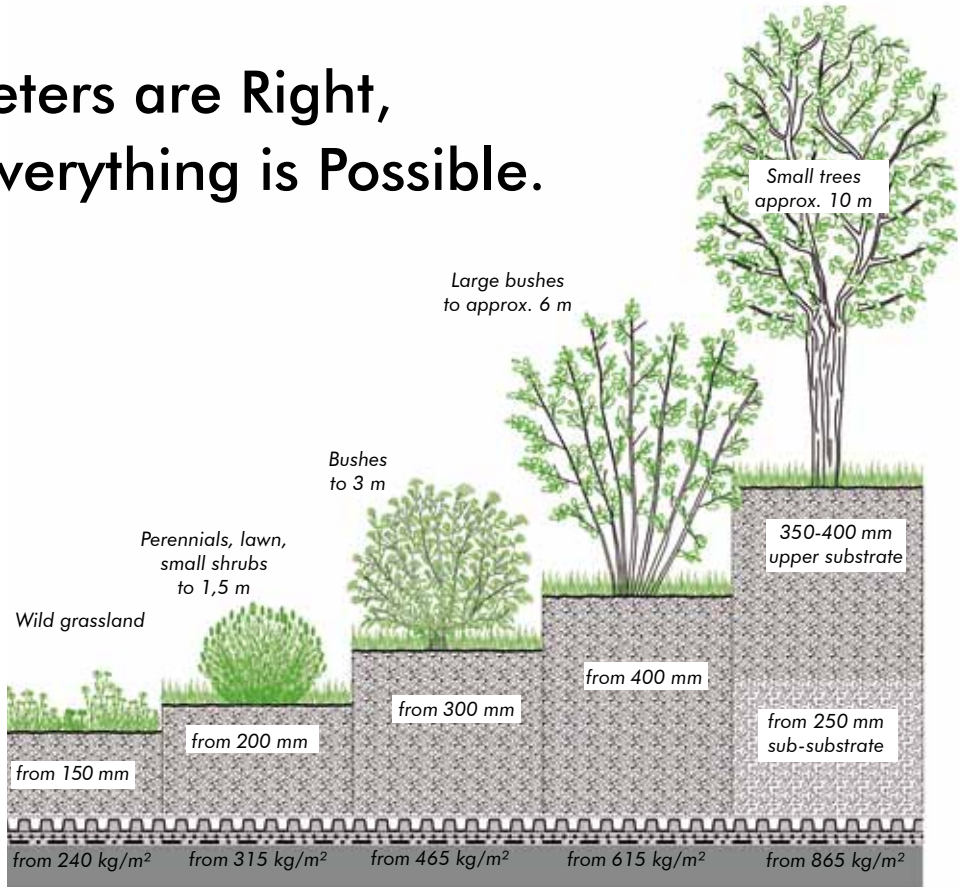


* If the intensive substrate is to be blown, the System Substrate "Roof Garden" can be replaced by "Heather with Lavender" System Substrate.

If Parameters are Right, Almost Everything is Possible.

Substrate Depth depends on Type of Plants

Plant growth is especially affected by the type and depth of applied substrate. On a substrate depth of approx. 150 mm, near-natural wild grasslands are possible. For sophisticated perennial plantings, as well as for bushes and trees, deeper substrate levels are required. The potential for horizontal extension of the roots of trees and bushes must be ensured. ZinCo offers a range of substrates with which every green roof request can be fulfilled.



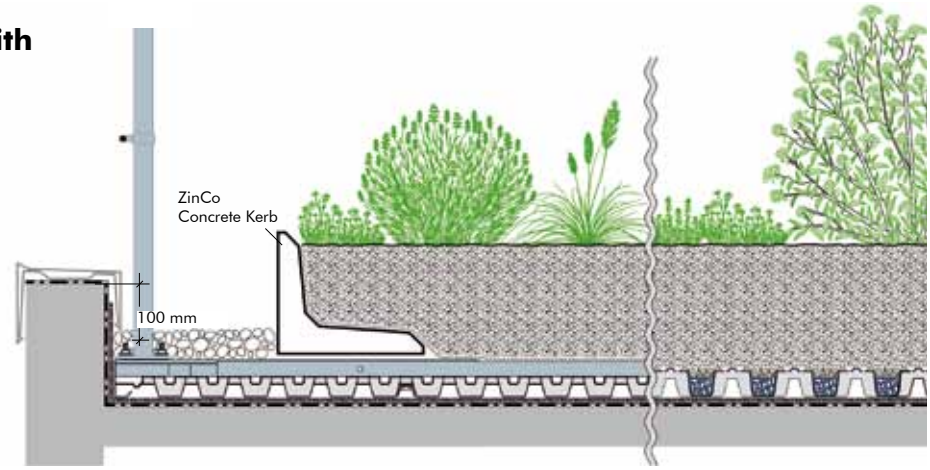
Perfect Solutions down to the last Detail

Planting Bushes and Trees

In order to establish trees and bushes permanently on roof areas, it is often necessary to create more space for the roots by forming special planting areas with higher substrate level, such as planters or mounds. Anchor fixings are often used for securing bushes and trees against wind damage and can be attached to the borders of planters. If there is no possibility to do so, the plants can also be tied for example, to galvanized reinforcing mats, which are laid into the substrate layer or fastened to perforated paving slabs. Within a System Build-up, not only "mounds", but also borders for areas of deeper and varied substrates are possible, for example, if bushes were to be planted around a roof garden for more privacy. An attractive possibility to create such borders are the ZinCo Concrete Kerbs.

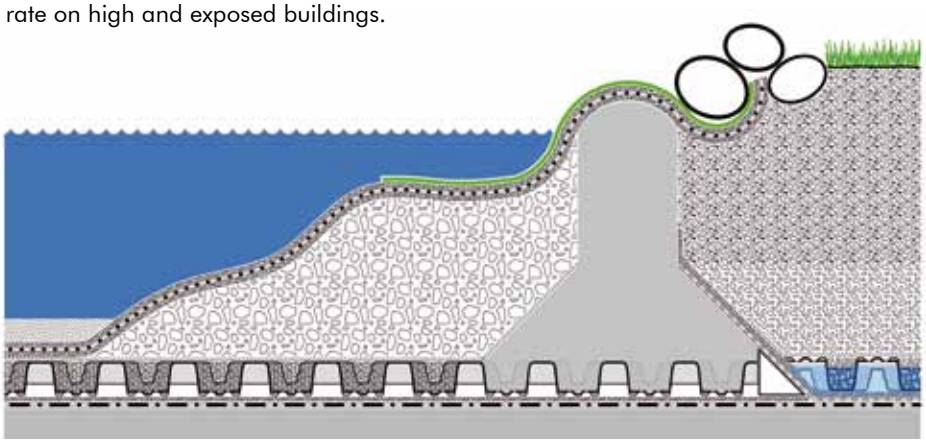
Intensive Greening on Roofs with Low Edging

Even with low perimeter upstands, intensive green roofs with higher build-ups can be installed. Concrete L-kerbs or stainless steel profiles, set in from the low perimeter, border the plant area and allow for a greater depth of substrate. Thus, they ensure continuous and effective drainage beneath the plant beds and the roof edge.



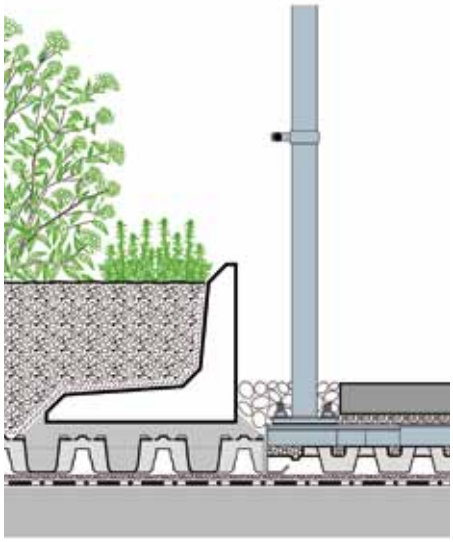
Ponds and Pools

With the correct design, ponds and pools can be installed on roof decks. They should generally be placed above the drainage layer and lined separately with a special plastic membrane; should the pool ever leak, the water will flow to the regular roof drainage. It is recommended to have at least 300 mm depth of water to compensate for the higher evaporation rate on high and exposed buildings.



The illustrated detail refers in particular to a ZinCo System Build-up. The roof structure is not to scale and has to be planned and executed in line with applicable standards and guidelines.

Top Priority for Roof Gardens – Solution without Penetration of the Waterproofing!



Guardrails

Roofs that are intended for access by people require a surrounding guardrail for safety purposes.
The ZinCo Guardrail Base GB is the perfect solution and it won't penetrate the waterproofing. The guardrail can be fitted without any special tools.
The required load applied to the guardrail base can be, for example, a green roof, gravel or terrace slabs on grit.
For further details, please see the ZinCo Planning Guideline "Fallnet® – Safety on Flat Roofs"
Simply order or download from
www.zinco-greenroof.co.uk

The guardrail base can be used with all ZinCo system guardrails and other proprietary guardrails with the appropriate mating flange!

Advantages at a glance:

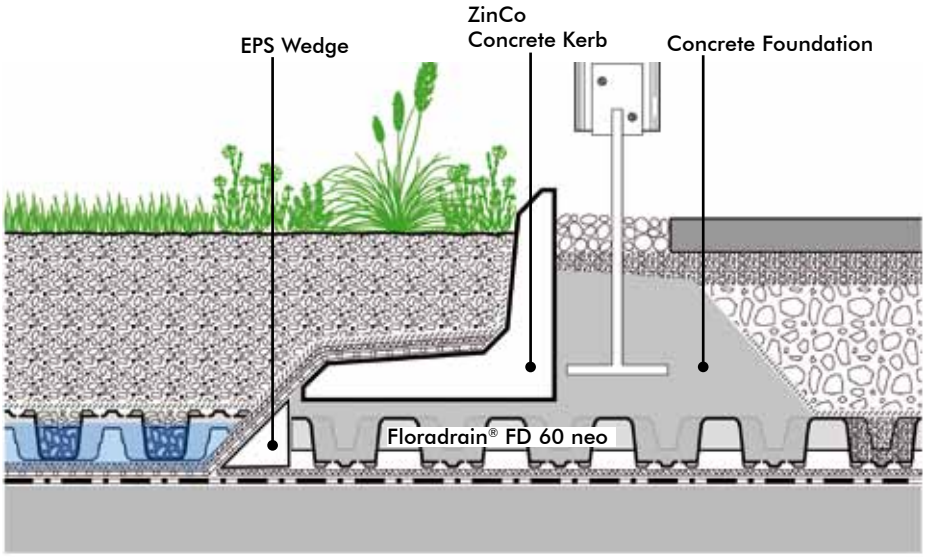
- Suitable for ZinCo system guardrails or building-specific guardrails with the appropriate mating flange
- For guardrail solutions and mountings without roof membrane penetration
- Structurally tested for horizontal forces up to 1 kN/m.
- Suitable for clearances between posts of at least 100 cm
- 90° corners possible with standard products
- Can be combined with Fallnet® SB 200-Rail.

Formwork and Foundations for Unlimited Design Flexibility

Floradrain® FD 60 neo can also function as lost formwork.
This provides for the foundations for all types of furnishing elements without the need for penetrating the waterproofing which often has its own risks. The underlying channel system continues to ensure that excess water is drained off.

The type and surface treatment of the concrete and the choice of suitable aggregates prevent the dissolving out of carbonates and provide protection against sintering.

A pergola can be incorporated without penetrating the waterproofing, be it for additional plant support or simply as a design feature. (See illustration right)



The complete drainage area remains intact when the foundation is built as a strip foundation. For dam up area (left), the waterproofing is drawn upwards so that water cannot enter the walkway build-up (right).

Garden Architecture – Combining Walkways and Green Roofs

Transitions and boundaries

Over-basement courtyards are increasingly integrated into overall building utilization. The combination of surfaces and planted areas is particularly popular. In this instance, the wood covering was installed on ZinCo Elefeet pedestals, which ensure excellent sub-surface ventilation and fast drainage. The System Build-up provides the edging for the walkway and also acts as a full area drainage element.

The boundary to the walkway has to be sufficiently high in the case of lush vegetation. Sandstone walls were used for this building in Frankfurt. The filled Floradrain ® FD 60 neo element proved to be the ideal basis for designing this leisure area at a lofty height.
The drainage system, continued beneath the walkway, ensures the permanent and proper functioning of the build-up.

Creating Space – with System!

This Planning Guide aims to give you a general overview of the technology involved in the various intensive green roof options.

Our technical experts will be pleased to advise you on specific solutions for your own individual building projects: from the planning phase right through to creating your specification texts.

More detailed information can be downloaded at
www.zinco-greenroof.co.uk
Challenge us!

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