PLANNING GUIDE

Solar Energy and Green Roofs

ZinCo

Life on Roofs

Exploiting Synergy Effects on Your Roof – with the SolarVert® System Build-up

Green roofs offer a wide range of benefits. They enhance thermal insulation, protect the waterproofing, offer a natural habitat for plants and animals, retain stormwater, improve the microclimate and create important garden and recreational areas.

Photovoltaic systems are used increasingly in combination with green roofs, as this offers considerable synergy effects: The green roof build-up provides the necessary superimposed load to resist wind suction loads. This avoids the need for complicated roof penetrations and prevents load concentration.

Compared with roofs that have a gravel layer or a bare membrane, green roofs provide for a lower ambient temperature, resulting in measurable benefits with SolarVert®.

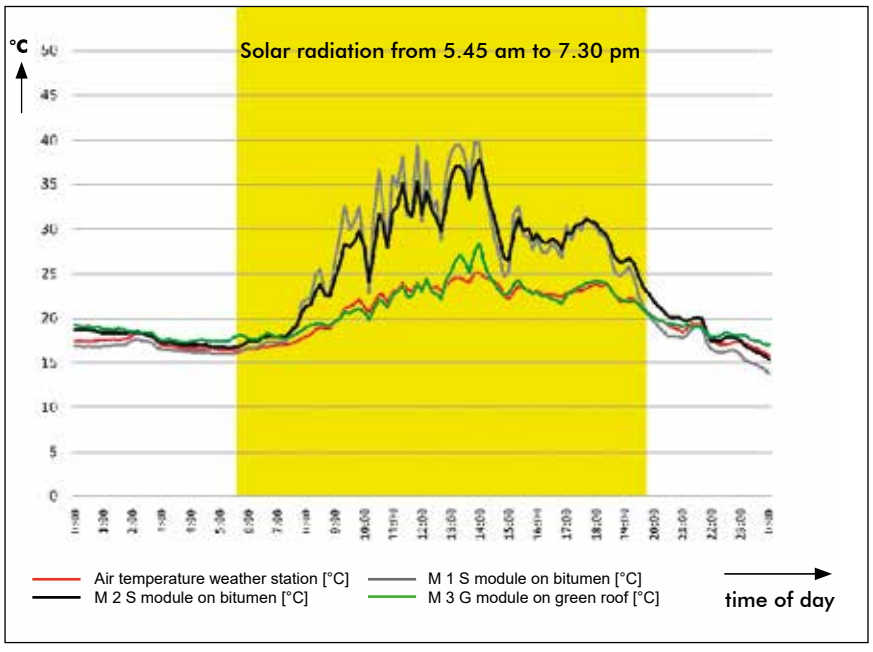
The Figures Prove It:

Green Roofs Improve the Efficiency of PV Modules Permanently

The efficiency of photovoltaic modules depends on their temperature. Generally, as a rule of thumb we say that "the higher the temperature, the lower the level of efficiency".

The temperature of Standard Test Conditions, by which these modules were examined , is 25 °C. In practice, the temperature of the modules increases considerably due to solar radiation. This is compounded by the hot surface of the roof, for example dark waterproofing or a gravel roof, which can easily lead to temperatures of up to 90 °C. A green roof, on the other hand, will retain a moderate temperature even on hot days, with the surface temperature rarely rising above 30 to 35 °C.

The temperature-related change in the performance of a module is demonstrated by the temperature co-efficient. It depends on the product and is up to 0.5 % per Kelvin (K) with standard solar panels.



Graph: example of temperature graph recorded on a day in July. The temperature of the modules over a bituminous membrane (black and grey lines) rises to almost 40 °C, while that of the module on the green roof (green line) does not go beyond a maximum of 27 °C and is, therefore, close to the ambient temperature (red line).

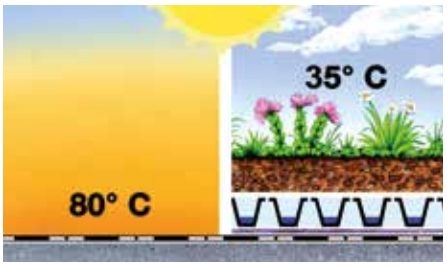
More Options with ZinCo

System Build-up SolarVert®

The ZinCo Solar Base adds a significant new benefit: the integration of solar energy use into the green roof build-up.
The ZinCo Solar Base is incorporated into the SolarVert® System Build-up. The function of the green roof as an ecological compensation area is not affected.
This system build-up is suitable for flat roofs up to 5° inclination and can also be combined with the fall protection device Fallnet® SB 200-Rail.

Partial view of the "InCenter" shopping mall roof in Landsberg/Lech, Germany. shortly after installation (left) and with established vegetation (right).

SolarVert® benefits at a glance:

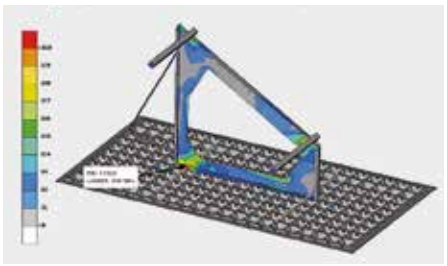


Improved performance due to the cooling effect of a green roof

Compared with roofs that have a gravel layer or a bare membrane, green roofs provide for a lower ambient temperature, resulting in measurable benefits with SolarVert® (see page 7).

Installation without roof penetration

The green roof build-up provides the necessary superimposed load to resist wind suction loads. This avoids the need for complicated roof penetrations and prevents load concentration.



Structural calculation allows for reliable planning

The structural calculation available for the solar base and the solar base frame is in line with the European Standards EN 1993-1- and EN 1999-1 (Eurocodes 3 and 9), see illustration above. This meets the requirements of DIBT (Guideline for the construction, planning and installation of solar energy systems, May 2012).

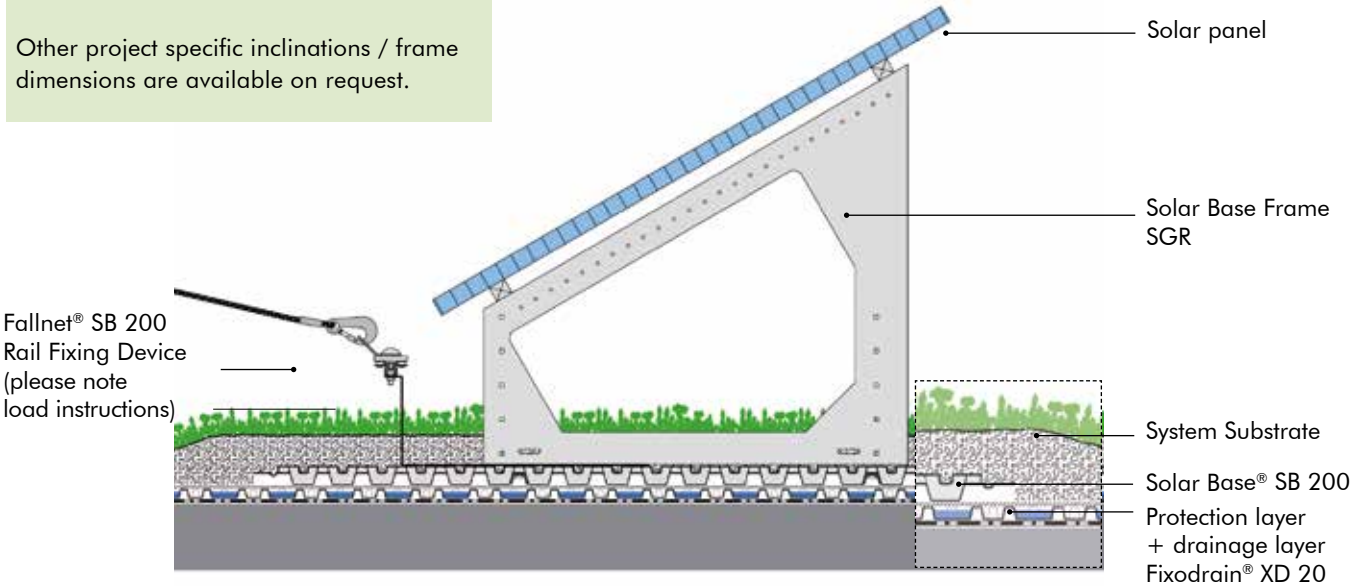
Also suitable for solar thermal installations

Unlike photovoltaic systems solar thermal collectors are usually installed with a steeper inclination on the roof. The Base Frames are available in 5° steps up to 45° as standard solution.

The solar base frame is available in different variations (inclination in increments of 5°):

SGR 5 (5 degrees) – SGR 45 (45 degrees)

Other project specific inclinations / frame dimensions are available on request.



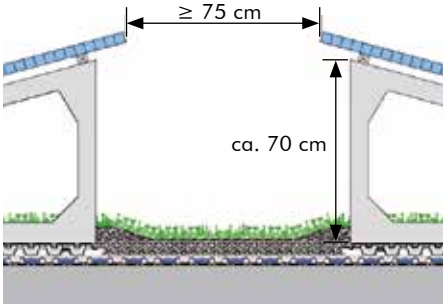
Build-up height:	from 120 mm
Weight dry:	from 94 kg/m² *
Weight saturated:	from 120 kg/m²*

*** Please note:**
The required superimposed load needs to be reached by the dry weight of the system build-up, while the load bearing capacity of the roof construction needs to support the water-saturated weight.
The dry weight of the build-up is decisive for the required superimposed load, while the water-saturated weight determines the design of the roof construction.

SolarVert® “Butterfly“ Type

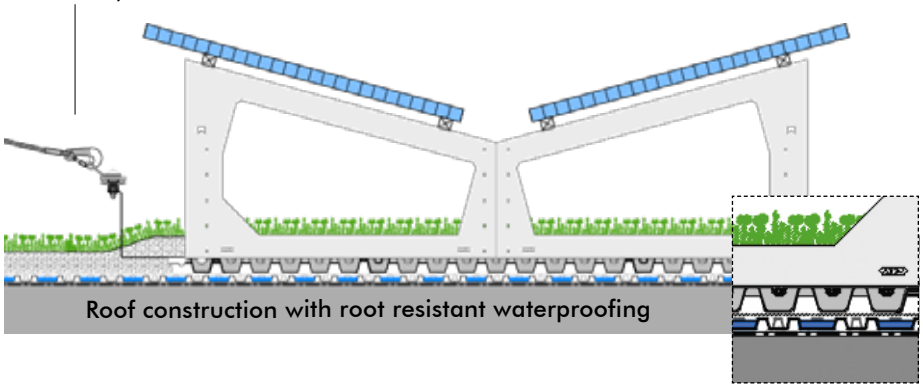
Modules in an east-west orientation can be designed either as a “saddle” or a “butterfly” type. For an assembly of type “Butterfly”, the two Solar Base Frames meet with their lower sides. Rainwater is directed to the middle of the Solar Base SB 200 and distributed from there in both directions. In this case, a rather lush vegetation can be expected under the solar panels.

The plants are relatively easy to access from the walkways between the panels because the panels have their maximum distance of approx. 70 cm to the substrate surface there.



System Build-up Using the Example of a “Butterfly“

Fall protection Fallnet® SB 200-Rail, if necessary



Roof construction with root resistant waterproofing

Solar panel

Solar Base Frame

Sedum Cuttings or plug plants according to plant list “Sedum Carpet“
System substrate “Sedum Carpet“
Solar Base® SB 200, with infill
Protection and drainage layer
Fixodrain® XD 20

Build-up height:	from ca. 120 mm
Weight dry / water saturated:	from ca. 90/120 kg/m²*
Water storage capacity:	ab ca. 26 l/m²*

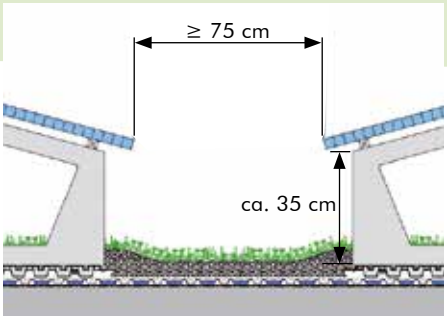
** Please note:*
The required superimposed load and the resultant weight of the build-up is to be determined by means of structural analysis, having regard to location and building geometry.
The dry weight of the build-up is decisive for the required superimposed load, while the water-saturated weight determines the design of the roof construction.

SolarVert® “Saddle“ Type

For an assembly of type “Saddle”, two Solar Base Frames are mounted onto a Solar Base SB 200 in a way that their higher ends meet in the middle.

The front edge of the solar panels has a sufficient distance to the substrate surface so that plants can still grow under the panels.

Given the high point between the solar panels, for example, snow is drawn to the outside edges.

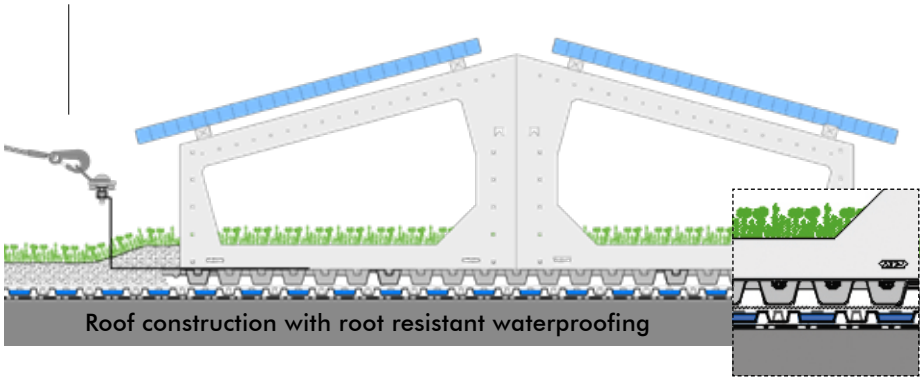


Ideally, the lower module edge of the sub-structure will be approx. 35 cm above the vegetation layer, in order to avoid shading from the plants.

The spacing between the rows of modules should be 75 cm at least to allow for efficient maintenance.

System Build-up Using the Example of a “Saddle“ Type

Fall protection Fallnet® SB 200-Rail, if necessary



Solarmodul

Solar Mounting Profile SMP 38/33

ZinCo Solar Base Frame SGR (SGR 5 – SGR 45)

Sedum Cuttings or plug plants according to plant list “Sedum Carpet“

System Substrate “Sedum Carpet“, from 60 mm *

Solar Base® SB 200, with infill Fixodrain® XD 20

Build-up height:	**from ca. 120 mm**
Weight dry / water saturated:	**from ca. 90/120 kg/m²***
Water storage capacity:	**ab ca. 26 l/m²***

** Please note:*
The superimposed load of bulk material (dry weight) required to provide static equilibrium of the solar build-up is to be determined using structural analysis, having regard to the location and geometry of the building, and should be adjusted where necessary.
The dry weight of the build-up is decisive for the required superimposed load, while the water-saturated weight determines the design of the roof construction.

SolarVert® with Vertical Module Arrangement

SolarVert® with vertical module arrangement combines the benefits of east-west orientation and south orientation. Performance can even be increased where suitable plants and bright underground areas are used.

Bi-facial PV modules use solar radiation from both sides. If they are arranged with the module axis facing South, the modules will have peak performance before and after midday, and will therefore feed electricity into the grid when conventional south-oriented PV units only have a low output.

The vertical sub-structure allows for a greater supply of water and light to the vegetation.

This sub-structure is particularly suited for regions where large volumes of snow are expected.

The aluminium Solar Base Frames SGR 90/48 and SGR 90/72 were designed specifically for use with bi-facial modules and are designed to fit the ZinCo Solar Base SB 200.

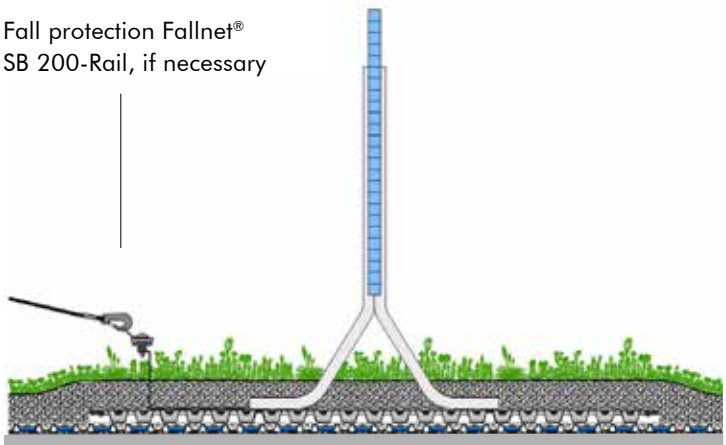
Solar System Type "Vertical"

Bifacial solar panel

Fall protection Fallnet®
SB 200-Rail, if necessary

Solar Base Frame SGR 90

Sedum cuttings or plug plants
according to plant list "Sedum Carpet"
System Substrate "Sedum Carpet"*
ZinCo Solar Base SB 200 with infill
Fixodrain® XD 20



Roof construction with root resistant waterproofing

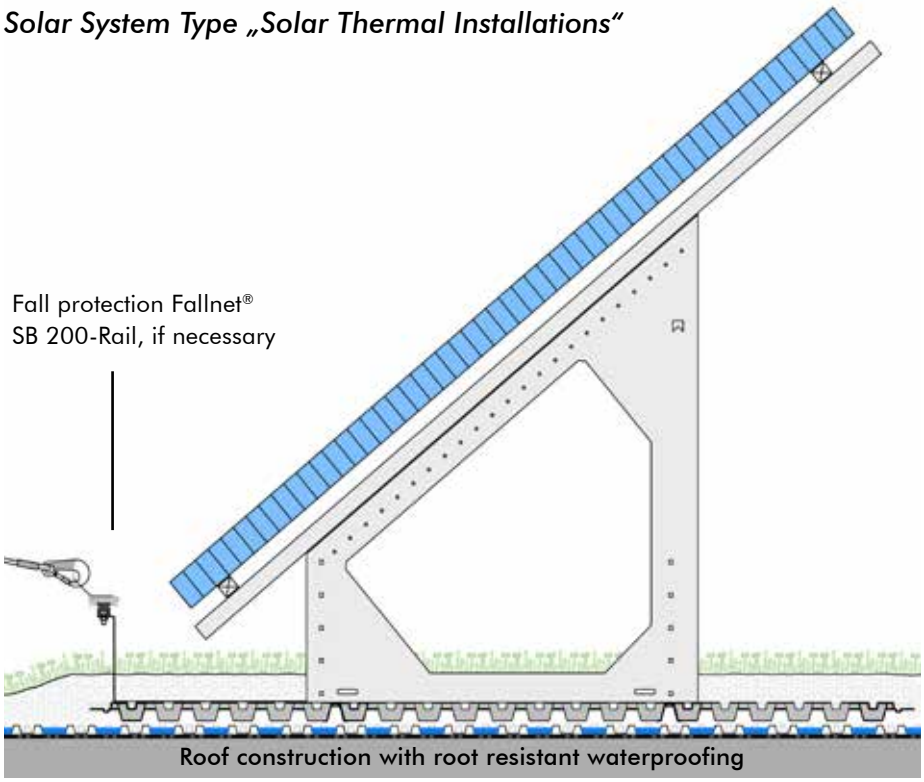
Build-up height:	from ca. 120 mm
Weight dry / water saturated:	from ca. 90/120 kg/m²*
Water storage capacity:	from ca. 26 l/m²

** Please note:*
The required superimposed load needs to be reached by the dry weight of the system build-up, while the load bearing capacity of the roof construction needs to support the water-saturated weight.
The dry weight of the build-up is decisive for the required superimposed load, while the water-saturated weight determines the design of the roof construction.

Solar Thermal Systems on Green Roofs

Most solar thermal systems are well suited for use in combination with a green roof. Unlike PV systems, however, solar thermal collectors (flat collectors or vacuum tube collectors) are usually placed more steeply on a roof at 40°-45°. The base frames needed here are manufactured in line with the requirements of the building.

Solar System Type „Solar Thermal Installations“



Roof construction with root resistant waterproofing

Build-up height:	from ca. 120 mm
Weight dry / water saturated:	from ca. 90/120 kg/m²*
Water storage capacity:	from ca. 26 l/m²

** Please note:*
The required superimposed load needs to be reached by the dry weight of the system build-up, while the load bearing capacity of the roof construction needs to support the water-saturated weight.
The dry weight of the build-up is decisive for the required superimposed load, while the water-saturated weight determines the design of the roof construction.

Solar thermal collectors**

Solar Mounting Profile SMP 38/33

ZinCo coupling profile

ZinCo Solar Base Frame SGR
(SGR 5 – SGR 45)

Sedum cuttings or plug plants
according to plant list “Sedum Carpet”
System Substrate “Sedum Carpet”,
from 60 mm*
ZinCo Solar Base SB 200 with infill
Fixodrain® XD 20

*** Please pay close attention to the manufacturer’s assembly instructions.*

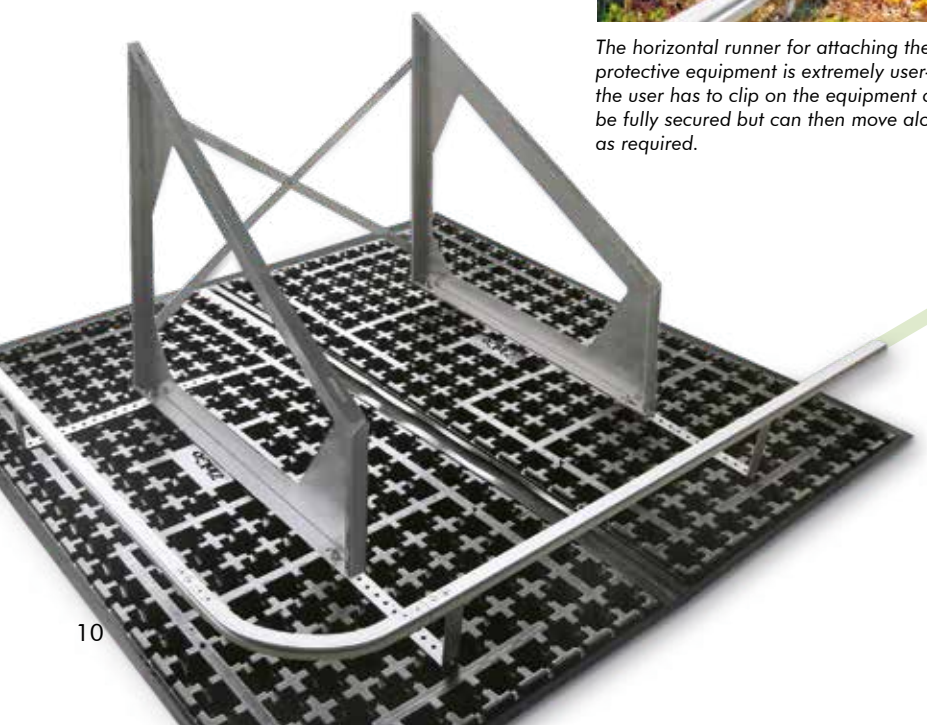
Your Safety is Our Priority: Fall Protection Fallnet® SB 200 Rail

Fall protection systems are required to prevent people from falling off flat roofs while working. Such work includes maintenance of solar energy systems. Single fixing points are usually not very useful as the solar panels often reach close to the roof edge.

The ZinCo Fallnet® SB 200 Rail fixing device offers a solution for this situation. It was designed especially for the use in combination with ZinCo Solar Base SB 200. The periphery of the existing photovoltaic system is also used for the fixing device. All you need in addition is a rail, rail supports and project related accessories. This allows for a quick and inexpensive installation of an effective fall arrest system that integrates well into the landscape.

The horizontal runner for attaching the personal protective equipment is extremely user-friendly as the user has to clip on the equipment only once to be fully secured but can then move along the rail as required.

Non-penetrating installation as the required load is provided by Zincolit® or system substrate or an alternative bulk material.



In order to fully exploit the available roof area, solar energy systems are generally installed right up to the roof edge. With the Fallnet® SB 200 Rail, you can work absolutely safely along roof edges.

Solar with Fallnet® ASG – the Intricate Fall Protection Guardrail

A collective fall protection solution such as Fallnet ASG has the advantage that each person working on the roof is at the same time protected from falling off the roof.

The ASG Maintenance Guardrail can be installed either vertically or at an angle and is easily combined with Solar Base SB 200.

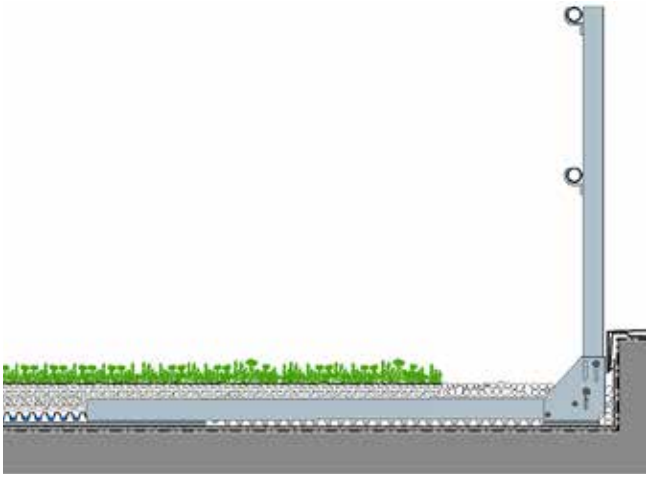
Fallnet ASG is compelling due to its easy handling, light weight and high level of stability. Naturally, it is installed without the need for roof penetration, i.e. it is held in place by the weight of the green roof.

This system is particularly suited for wide distances and large-scale projects due to the small number of components which allow for quick assembly, and its infinitely adjustable, large span width of up to 2.6 m between the rail posts. The entire system can be assembled with only one tool, a cordless screwdriver.

Small irregularities can be balanced out by adjusting the height. The Fallnet® ASG is Dekra-certified.

An overview of the benefits:

- Complies with ARGEBAU and DGUV recommendations
- Quick assembly
- No heavy point loads
- No roof penetration
- Meets EN 13374 Class A
- Can be used for up to 5° roof pitch
- Green roof build-up is used as ballast
- Simple and easy to install, regardless of the sub-surface



Fallnet® ASG
Post module
Handrail

Mid-rail

Gravel strip
Vegetation layer
System substrate
Floradrain® FD 25-E
Protection Mat SSM 45

Enduring and Technically Sound Solutions.

This planning guide aims to provide you with a general overview of how solar energy technology is combined with green roofs.

Our engineers will be glad to help you work out the details for your own particular project; from the planning stage right through to creating the required specification texts.

Bild: Stadtwerke Weilheim i.OB

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