

AS-GREEN SLOPE

Installation & Maintenance Manual

AS-GREEN SLOPE

Vegetation Bags

Installation & Maintenance Manual

Contact: ASIO NEW, spol. s r.o., Kšírova 552/45, 619 00 Brno, Czech Republic
Phone: +420 548 428 111
www.asio.cz
asio@asio.cz

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Dear Customer,

Let us thank you for buying our product.



Please, read carefully this manual before the product installation and use. Follow all important instructions and safety warnings. Consequently, keep the manual at a safe place for further use.

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1. Introduction

This Manual should help you to familiarise thoroughly with the product and advise you how to carry out its safe installation and subsequent use.

If you follow this Manual, then all procedures of safe use will be conformed at a level corresponding to the currently valid safety standards and codes as well as the correct technical procedures.

The adherence to all the instructions and procedures herein set forth is a prerequisite for safe and trouble-free operations. Any damage or losses caused by inadequate handling, improper use or operator's faults make null and void any claims for free warranty repairs.

You are kindly requested to read these instructions thoroughly before design & installation works and/or any other handling with the product (equipment), and to turn to ASIO NEW, spol. s r.o. in case of any doubts or uncertainties.

Very important instructions and notes in this document are marked graphically as follows:



Attention - Danger! – This highlights important information that must be taken into consideration in order to provide for safe equipment functions and avoid any damage.



Warning – This highlights information on conditions and procedures representing threats of injuries or fatal injuries if not properly observed/treated.



Forbidden activities – This identifies forbidden activities.

Other important instructions

2. Product safe use principles

2.1. Attendant's ability age

Only persons older than eighteen years, mentally and physically fit for such type of work, professionally competent, familiar with this Manual, and demonstrably familiar with and trained according to the relevant national regulations, may attend and maintain the equipment. Safe work principles

During the installation and maintenance, works observe the below-given general safety principles as well as the instructions set out in individual chapters of this manual...



While working, follow this Manual, design documents, current national and local regulations as well as manuals and instructions for individual auxiliary elements.

While working, use the personal protective equipment required by the relevant regulations.

Before you start the work, make sure that under the load handling area there are no persons and/or things that might be injured or damaged by the falling load.

2.2. Design of a retaining wall made of vegetation bags

Before designing the retaining wall itself, please familiarise yourself with the local regulations and requirements for building warrants with the relevant authority.



Never build the retaining wall unless its design is structurally evaluated by a professionally competent person.

In designing of the remaining wall itself, it will be necessary to take under consideration local hydrogeological condition. In addition, the ground profile as well as external condition loading the slope (if any), will be equally important, which may be caused by a neighbouring road/lane, etc. All these aspects must form an integral part of the design.



Any changes/variations against the original design must be always consulted with a specialised designer.

3. Product use

AS-GREEN SLOPE is a systematic solution for structural reinforcements and stabilisation of various slope types. This system is suitable for both do-it-yourself domestic designs in garden modifications or slope stabilisations as well as large-scale commercial applications, such as slope stabilisations, water stream revitalisations, building of foundation slabs or various environmental solutions.

Vegetation walls offer a large scale of numerous architectural solutions. Due to their structural flexibility and system of laying, even complex slope shapes or creation of terraces constitute no problem. The slope stability – depending on its size and gradient – can be provided by geogrids anchored among separate rows of bags and intertwined into the existing slope.



Using the vegetation bags, the slope stabilisation system counts on complete covering of the bag surfaces with vegetation, which prevent the effects of ultraviolet (UV) radiation mostly on the bag fabric; this will result in the bag lifetime in the order of decades.



The bags are NOT intended for installation under direct sun radiation **without covering by greenery or any other protection against UV radiation.**



It is forbidden to climb up the slope of the reinforcing wall. There is a risk of slipping.



Made in the Czech Republic. Vegetation bags are manufactured in the Czech Republic. By doing this, we reduce the carbon footprint connected with the transport.



Vegetation bags are manufactured from 100% recycled materials on basis of non-woven fabrics.

4. Product description

AS-GREEN SLOPE represents a systematic solution for structural reinforcements of various slope types by the use of vegetation bags.

The vegetation bags are sewn from special breathable fabric that allows root intergrowth without any infringement to improve bag structural properties. Greenery provides not only its aesthetic function but it also serves as an element improving local microclimate. In system terms, the product is used as a suitable solution for water stream revitalisation. The bag breathability supports the interaction between the rived bed and its neighbourhood, which facilitates groundwater replenishment. It minimises the need for draining system installations in the stabilisation of larger slope complexes and it supports water intake to the roots of newly planted vegetation.

In order to bridge over differences in height or stabilise slopes, concrete pavers or brick solutions are often used; however, they are not optimal for their high volume weight, minimal water permeability, and poor noise attenuation. Vegetation bags AS-GREEN SLOPE represent a unique alternative for such conventional solutions; they are more environmental friendly and they do not tend to create “heat islands”.

Commercial markings

AS - GREEN SLOPE

AS - this identifies the product of ASIO

Product/system name

Literacy translation “green slope” - it consists of components described in this Manual.

AS-GREEN SLOPE consists of:

- **vegetation bags**, including sewn-in binding tape for bag closing,
- **fixing anchors** (at least two per bag),
- **geogrids** – if necessary, this ensues from the structural design,
- **vegetation components** – e.g. grass seed, wild stonecrops, climbing & perennial plants, etc., they are optional or they can be applied subsequently,
- **drains** – if necessary, this depends on the structural design, and
- **bag infills** – various solutions depending on the type application; the backfill obtained from the original stabilised slope can be advantageously used.

4.1. Vegetation bags

Vegetation bags are sewn of special breathable fabric and fitted with a sewn-in tape for bag closing. This special fabric allows root intergrowth without any infringement thorough the bag structure. Vegetation bags are manufactured from 100% recycled materials on basis of non-woven fabrics. The material is resistant to UV radiation but - at the same time – it is necessary to provide as soon as possible for covering the surface with green plants. If the bags are protected against UV radiation with greenery, their lifetime is at least thirty years*.

** In natural earth types of pH value within the range of $4 \leq \text{pH} \leq 9$ and earth temperatures $\leq 25^\circ\text{C}$ (B.4.2.2, EN ISO 13438), and the coverage within fourteen days after the laying time according to ČSN EN 12447.*

Technical specifications:

Basic vegetation bag

- Empty bag dimensions 750 by 460 mm, weight approx. 175 g



- Full (compacted) bag laid on ground forms a “theoretical plastic brick” of dimensions of 550 × 350 × 150 mm (length × depth × height), weight 20 to 40 kg (according to the filled material)



- Full bag volume: 0.029 m³, i.e. approx. 29 litres



- Colour: anthracite
- Consumption: 13 pcs per m²

Enlarged vegetation bag

For industrial/large-scale installation, we can offer even larger bags. However, such enlarged bags may be clumsy in handling due their weight. Therefore, we do not keep this size on stock, but these bags are available upon request.

- Empty bag 980 × 460 mm, 200 g
- Full bag dimensions 750 × 350 × 150 mm, **30-60 kg** (according to the filled material)
- Full bag volume: 0.039m³, i.e. approx. 39 litres
- 9 pcs per m²
- Colour: green, or anthracite (according to current manufacturing series)



Due to sunshine radiation, the material strength properties are decreased, but residual strength higher than 80 % is expected after one-year exposition and above 50 % after two years of direct sunshine effects. It is therefore important to provide the bags with green plants and thus cover the area surface.

4.2. Fixing anchors / pins

Fixing anchors, sometimes called also as fixing pins, are used for creation of a well-knit pattern among individual bag rows. At the same time, the anchors/pins fix the geogrid. In the basic arrangement, two pins are assumed per one bag. However, in some cases (connecting nodes, corners, etc.), it may be necessary to anchor the bags by more pins.

U-Pins (supplied by December 2023): material ABS, U shape, total length: 350 mm, spacing 90 mm



I-Pins (supplied from January 2023) nail shape with reverse-pointing thorns (five rows of total length 250 mm; nail head dimensions: 40 × 40 mm.)



As an alternative to the above offered pins, it is possible to use a rebar (weldable ribbed reinforcing steel bar) of 8 mm minimum diameter, curved into deep “U” shape, spike lengths at least 250 mm, spike pitch 50 mm.

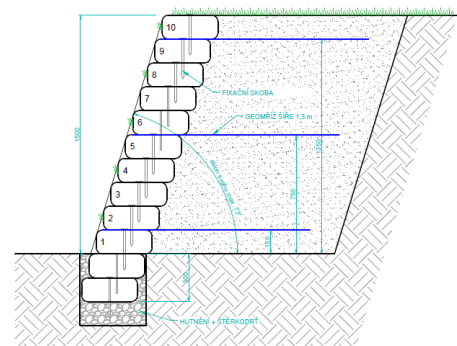
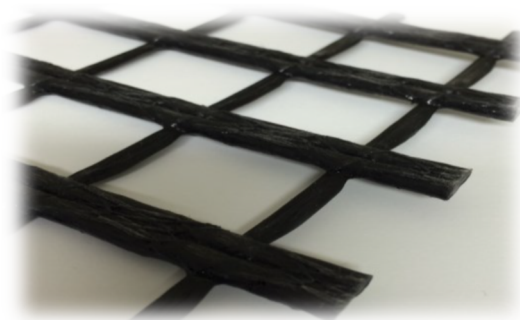


4.3. Geogrid

Principally, the geogrid is used for structural reinforcements of slopes higher than one metre. Regularity and placement positions must form an integral part of the structural design for the slope stabilisation with the AS-GREEN SLOPE products. Such design must be verified by a professionally competent person.

Upon request, ASIO can provide a structural expert opinion.

SLOPE – SECTION THROUGH



Knitted grids are made of high-strength multifilament polyester threads and coated with black PVC; this provides for the optimum stability against UV radiation. The reinforcing grid is woven from high-tenacity polyester threads and coated with a protective layer (PVC, etc.). The grid mesh size (for XGrid PET) is variable for 25 to 30 mm in order to achieve various tensile strength values. In this way, the tensile strength fluctuates from 20 to 600 kN/m, while the tearing strain is from 10 % to 12 %.

5. System installation procedure

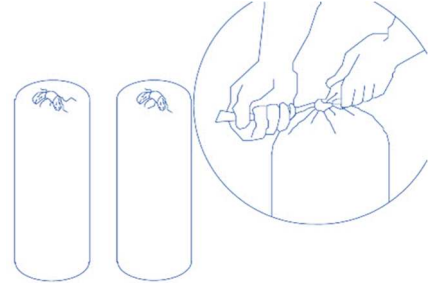
5.1. Filing and tying-up of vegetation bags

The vegetation bags can be filled on the spot with excavated earth, if such earth:

- does not contain large portion of clay or dust particles, and
- is sieved and does not contain particles larger than 20 mm.

In case of unsuitable earth properties, or locally excavate earth, it is recommended to fill the bags with a mixture of 70% of gravel-sand earth and 30% of organic/humous portion. Grass seed can be added into the mixture, as needed.

The bags should be tied up with the tape sewn into the bag. It is not necessary to tighten a complicated knot, a simple kink is sufficient. The tape secures the bag against entangling only, so that even simple kink is appropriate.



Earth containing clay and/or dust or other materials of high plasticity are not recommended as bag infills!

Vegetation bags can be filled individually or by the use of the so-called filling benches. ASIO offers lending of these benches. Up to ten bags can be filled at a time. In addition, the bench width allows filling the bags by a front loader.



Filling bench



Filling bench dismantled for its transport

The bags should be filled evenly – do not overstuff them. At the same time, it is recommended to fill the bags (in a single installation) with the same mixture.

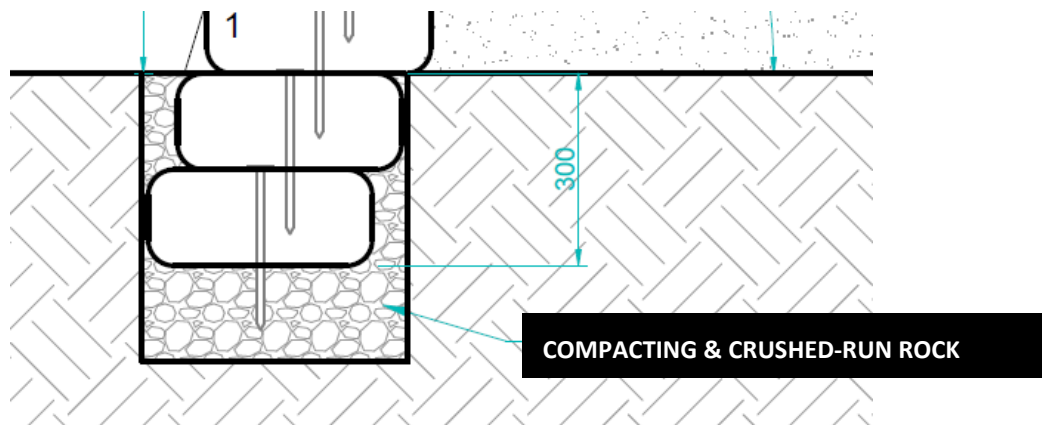
The only exception is represented by installations in places of water occurrence (either surface or groundwater). In such places, the bags are to be filled with gravel 8/16 fraction). For instance, for stabilisation of creek beds, the bags are filled with gravel above the usual stream level, but next one above this row contains humous component in the ratio of 60 % gravel and 40 % soil for sustainable greenery on the bag surfaces.



5.2. Laying of strip footing and of subsequent rows

The strip footing serves for fixing the vegetation wall and its protection against erosion effects. In case of normal laying, proceed as follows.

- (1) Excavate a trench at least 300 mm deep and 600 to 800 mm wide
- (2) Spread grit on the trench bottom (grit/gravel 4/8 or 8/16 fraction) up to the level of 150 mm.



If the vegetation wall is to be built above the height level of 1.5 metre, it will be necessary to prepare design documents and strengthen the strip footing.

It is recommended to consult the earth strengthening always with an expert, even in cases of lower (dwarf) walls. Slopes above 0.6 metres may need stabilisation with geogrids or other measures as necessary.

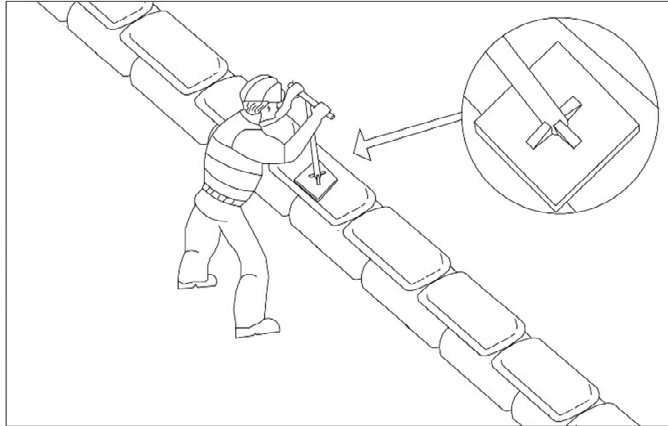


In installations of the AS-GREEN SLOPE system for the stream bank stabilisation, it will be necessary to consult the strip footing details with a professionally competent person for the foundation design assessment.

Two to three fixing pins are punched into each bag in each row for providing of complete interlacing and strength of the vegetation wall. In the foundation layer, the pins are driven through both first bag row and gravel bed as

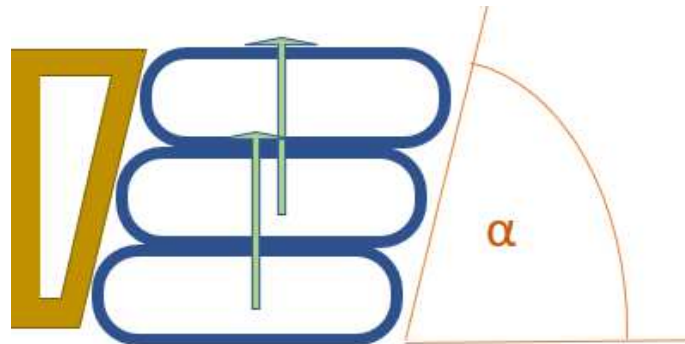
far as to the foundation layer (see the diagram).

Place the first row of bags longitudinally into the excavated trench with approx. 3 cm spacing among the bags. Use a tamping ram or other “light” compactor in order to align the bags into free places and create thus a horizontal surface plane.



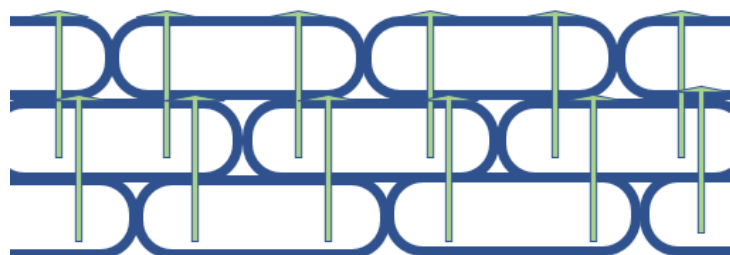
Hand-operated ram

The system of AS-GREEN SLOPE bags enables to create the vegetation wall in the gradient as steep as of 1 : 0.3 (73°). In order to secure the set gradient, it is recommended to prepare timber layout frames and place them to the strip footing; this makes to possible to install the system in the required gradient (see the figure below)



Apart from layout frames, layout boards or any other suitable solution may be used (laser, string, etc.) ensuring that the gradient is kept right.

In their standard design, the vegetation bags are laid in cross-wise or brick-wise patterns (see the picture) overlaying each other by bag one-half.



Brick-wise laying pattern of vegetation bags

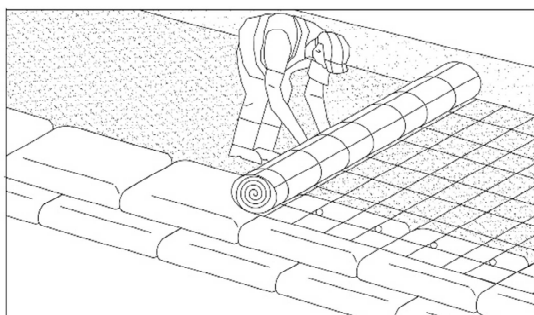
Consequently, the pins are placed in the bags in a manner so that each of them penetrates into one bag of the underneath row. Again, the bags are laid with spacing of 3 cm among them; the gap is settled during the bag compacting.

At both ends of the vegetation walls, where (because of bonds) one half of the bag is missing, the bag of the same size is used but laid with 90° turn and embedded into the slope so that it aligns with the rest of the wall.

5.3. Installation of fixing geogrids

If in the design of the AS-GREEN SLOPE vegetation wall it is necessary, in order to improve earth stability (mostly in applications on slopes of 0.6 metres and higher), the geogrid will be laid together with the installation of bags. The geogrid length of its flush mounting into the slope and its vertical spacing among individual layers is always specified according to the layout design solution based upon a structural assessment.

According to the specified geogrid length, it is necessary to dig away a part of the slope and consequently to compact the place and cover it with the geogrid. Finally, the slope – due to its own weight and that of the vegetation bags will be stabilised in this place and protected against deformations. The geogrid is laid horizontally on already compacted layers.



In the installation of geogrids, proceed as follows.

- (a) Unroll the geogrid in the length as required, in the direction from the vegetation bags to the slope or unroll it lengthwise with the last row of vegetation bags. The geogrid must be tightened in the direction of acting force.
- (b) Once the geogrid is laid, fix it to the vegetation bags with the same pins/anchors used for fixing the bags to the system.
- (c) Once the geogrid is fixed, tighten it and remove creases, if any.
- (d) Finally, place another two layers of vegetation bags (number of vegetation bags and compacted earth thickness represent a part of the structural design) and backfill the space between the bags and the existing slope, compact it and – if necessary – lay on another geogrid layer.

5.4. Slope backfilling and compacting

Backfill and compact the infill materials after each two rows of bags. Structures with very gentle slopes may require partial backfilling in each row in order to prevent sliding of bags. Compacting should be carried out by layers of maximum thickness of 25 cm. A vibrating plate is recommended for compacting procedures.

*** The typical gravel backfill used with concrete units is not recommended for the AS-GREEN SLOPE structures. Vegetation grows through the vegetation bag into the backfill area, by which the structure is further stabilised*



Compacting of layers by the vibration plate

During the laying works, do not forget to check for flatness of individual layers. If necessary, used a tamping ram to level irregularities up or lay an uneven (not horizontal) section again.

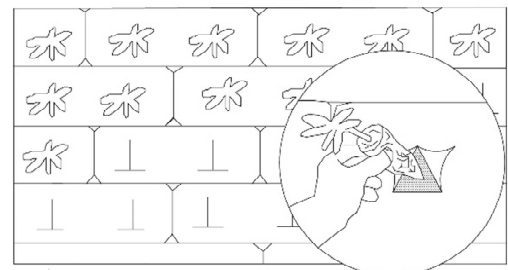


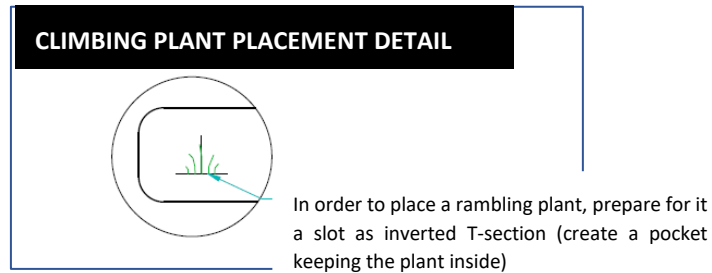
Checking the top row for flatness

5.5. Slope revegetation

Vegetation may be installed either during or after completion of the work. Plant are inserted among the bags and during the wall building. Planting or hydroseeding is carried out after the work completion,

In planting, make up to three small pocket (T-shape) slots, 8 cm by 8 cm in each bag for 10 cm high plants. The slot size for planting should be adapted to the plant size – do not cut unnecessarily large slot.





If you wish to combine hydroseeding and planting, apply the seed first and then add the live plants.



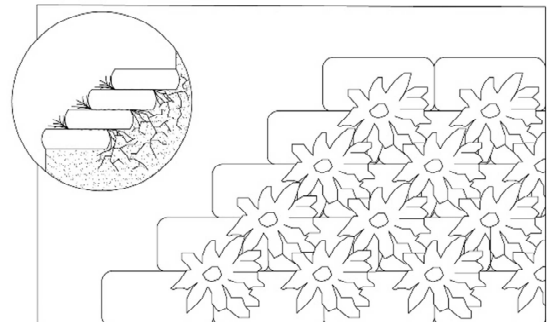
Before planting, soak the structure with water thoroughly.

Regular irrigation is also necessary in first several weeks after planting.

The plants should be inserted among the bags in a manner where their roots are placed beyond the vegetation wall. Planting is carried out by pushing a stem/branch directly into the space of vegetation bags.

Another alternative is pre-seeding of bag infillings; this can be combined with any other procedure shown above for vegetation add-ons.

Even though the selection of suitable vegetation is the owner's preference, at least it should be consulted with local experts. Varieties of grass types, small shrubs, and earth-covering plants that are suitable for local climatic conditions, will decrease water consumption and increase the plant life sustainability.



Examples: Pocket planting of climbing plants



Hydro-seeding

6. Product marking

Each vegetation bag has its label with the ASIO Logo sewn-in on the inner side of the bag edge.



7. Technical specifications

Product specifications:

	AS – GREEN SLOPE		Note
	Basic(standard)	Extended	
Empty bag dimensions	750 × 460 mm	980 × 460 mm	
Dimension of filled and laid bag (theoretically brick shape)	550 × 350 × 150 mm	750 × 350 × 150 mm	
Consumption per m ²	13 pcs	9 pcs	
Weight	20 ÷ 40 kg	30 ÷ 60 kg	According to filling materials
Colour	Anthracite	Green	It can differ due to current manufacturing conditions
Filled volume	29 litres	39 litres	

8. Packing, transport & storage

8.1. Packing

Standard delivery of the equipment usually includes:

- set of vegetation bags with sewn-in tightening tape for closing ,
- fixing plastic anchors/pins (usually two to three pieces per bag) packed usually by 50 pcs bundles, and
- geogrid (usually for slopes higher than one metre).

An example of a package of 120 pcs of vegetation bags and 240 pcs of fixing pins:

Packed in two paper boxes.

- 120 pcs of vegetation bags in a paper box: 61 × 44 × 88 cm, package weight: 23 kg
- 240 pcs of fixing pins in a paper box: 39 × 30 × 31 cm, package weight 5 kg

8.2. Transport

Due to the dimensions and weight of empty bags, any kind of transport is suitable.

8.3. Storage

Store all the delivered elements outside UV radiation, optimally at a dry place and constant temperatures.

9. Recommended tools

In order to build a retaining wall with AS-GREEN SLOPE elements, it is recommended:

- rubber mallet,
- spirit level (at least 1.5 metre long),
- spade, shovel, rake,
- gardening gloves ,
- tamping ram, and
- vibrating plate.

- scissors or suitable knife for cut the geogrid short,
- dibble scoop or punching peg for vegetation planting.

10. Maintenance

10.1. Structural checks

Check for the system integrity for potential breaks in some bag parts due to greenery cutting, or if cracks in some bag cuts for planting do not propagate. In such cases, it will be necessary to replace the bag.

If a part of a slope is shifted/dislocated, it will be necessary to identify the cause and consult with experts suitable measures.

10.2. Care about greenery

Climbing plants are assuming great importance for public areas in the current municipal environment. Due to their growth, they are not space demanding. They are growing on surfaces and they do not create bulk masses, as trees.

Irrigation

Irrigation quantities and frequency depend on the site local conditions and demand of plant species. Some types of climbing plants are demanding for regular irrigation, e.g. types of Actinidia (Lindl.) or hybrids of Clematis (L.). In addition, younger plants (several years after planting) may suffer from draught more than other. The same applies to plants planted near building structures. On the other hand, types like Celastrus orbiculatus (Thunb.) or Campsis radicans (L.) can survive temporary dry periods.



It is not advisable to irrigate plants at high temperatures during the day.

According to specialized literature, the total quantity of 40 litres per month is considered as sufficient irrigation for perennials. In case of yearling plants, the relevant quantities differ according to the planting conditions (in pots or freely, etc.).

Fertilization

Additional fertilization intensity is based on plant types and soil conditions on the site.

In case of nutrient deficiency in soil, only small growth occurs with climbing plants, poor flowering or leaf bleaching.

It is recommended to use organic fertilisers (manure) in early spring.



In case of artificial fertilisers, it is necessary to know the soil current state. Soil analyse provides information for sound utilisation of fertilisers. If such information is ignored, excessive use of fertilisers may happen with adverse effects to plants and soil organisms.

Artificial fertilisers (such as Cererit, NPK, superphosphates) may be used during spring or first half of summer.

Frost protection

Light protection against frost is suitable for some climbing plants mostly in first years of their life, such as Wisteria sinensis (Sweet), Actinidia chinensis (Planch.), and Campsis radicans (L.). It is therefore advisable to cover these plants in first years after planting with spruce brushing at their footing up to the height of 20 ÷ 30 cm GUNDEL 2005, pp. 20-31). Evergreen plants, e.g. Hedera helix (L.), Euonymus fortunei (Turcz.), or Jasminum nudiflorum (Lindl.) transpire, or lose water, even through the winter period. Plant roots are not able to acquire sufficient water quantities from frozen earth. Therefore, abundant irrigation during a frost-free period would be useful

(GUNKEL 2005, pp. 20-31; LUDWIG 2005, pp. 69). Damage caused by frost can be prevented in thermophilic species (such as *Wisteria sinensis* (Sweet)) by correct planting as regards their exposition to the points of the compass. Plants exposed to the north and in shady places are deprived of sunshine resulting in insufficient maturity of leading shoots. In southern places, premature breaking of shoots may happen. Consequently, these shoots may be burnt by late frosts. Therefore, the most suitable position for climbing thermophilic species are southwestern and western orientated positions (GUNKEL 2005, pp. 20-31; LUDWIG 2005, pp. 69). However, some plant species such as *Clematis* (L.) and *Rosa* (L.) require special protection against frost - for more information on such measures, consult specialized literature (GUNKEL 2005, pp. 20-31).

Protecting plants from pests and diseases

In order to prevent attacks of pests and diseases, it is advisable to choose correct placements and provide subsequent care. Of course, atypical weather conditions in some season of the year cannot be influenced. If climatic conditions are poor, plants tend to be more vulnerable to such attacks (GUNKEL 2005, pp. 91-92; SOUČKOVÁ 2000, pp. 21-22). Plant lice belong among the most usual insect pests. However, majority of climbing species tolerate this pest without greater problems. In addition, their natural enemies partially reduce their activities (GUNKEL 2005, pp. 91-92; SOUČKOVÁ 2000, pp. 21-22). Chemical protection is not often considered environmentally friendly (SOUČKOVÁ 2000, pp. 21; GUNKEL 2005, pp. 91-92). Even though biological insecticide are regardful to pollinators, they can be rather used only in preventive measures. In addition, GUNKEL (2005, pp. 91-92) mentions using leachate prepared nettles against lice and horsetail leachates against rusts. In this case, these leachates provide only a preventive effect. SEITZ (2004, pp. 46) also mentions potential measures against pests by planting of species hostile to such pests. Climbing plants are then protected if such species are planted in their neighbourhood. By growing *Lavandula angustifolia* (Mill.) or *Tropaeolum majus* (L.) may deter occurrence of several species of lice. Climbing species *Rosa* (L.) are more vulnerable to pest and disease attacks (GUNKEL 2005, pp. 91-92).

Pruning

Pruning of climbing plants varies wildly with plant species and/or their life cycle. Perennial climbing plants, such as *Humulus lupulus* L., are to be removed every year closely to the ground because their aboveground part die away every autumn. Specific pruning is required for species of *Clematis* (L.) and *Rosa* (L.) (GUNKEL 2005 pp. 24-33). BRICKELL (2005, pp. 268-269, 316-317) very similarly studied in detail by pruning these species. Other species of climbing plants manage without regular pruning, while in some cases it is necessary to do pruning only to support pollination and proper fruiting (such as *Actinidia* Lindl.), or to carry out trimming cuts (*Jasminum* L.) or cuts supporting new offshoots in lower part of climbing plants (*Lonicera* L.) (GUNKEL 2005, pp. 90-91; BRICKELL 2005, pp. 250-250; LUDWIG 2005, pp. 69). Many types of climbing plants tolerate even radical pruning. Radical pruning is usually performed if the plant growth declines or the plant blooms insufficiently or exceeds planned space boundaries (GUNKEL 2005, pp. 90-91; BRICKELL 2005, pp. 247). It is suitable to perform radical pruning at the end of autumn or in winter or early spring (GUNKEL 2005, pp. 90-91). BRICKELL (2005, pp. 251) states as suitable time for maintenance pruning in the time of dormancy with the exception of evergreen plants, where pruning is possible even in summer time.

11. Repairs

Repairs should be made only in the scope of replacements of individual parts of the structure with parts supplied by ASIO NEW, spol. s r.o.

12. Dismantling and liquidation

Before dismantling procedure, remove climbing plants from the structure. Consequently dismantle the structure according to this Manual but in the reverse order of steps described above (according to Chapter 5).

Used materials:

Vegetation bag - Polyester (PET),
Fixing pin - PVC,
Geogrids- PET fibre coated with PVC,
20 02 02 Earth/Soil

13. Servicing and spare parts

Any servicing works and/or spare parts can be ordered at the address:

ASIO NEW, spol. s r.o.
Kšírova 552/45
619 00 Brno
Czech Republic
Phone: +420548428111
E-mail: asio@asio.cz

Servicing works can be also ordered at authorised representatives of ASIO NEW, spol. s r.o. according to the list displayed at www.asio.cz

The manufacturer reserves the right of changes in the equipment with the aim of improving the product utility properties.

Made in Brno, July 2023

