# **Associazione Italiana VErde Pensile**

## Italian Association of Green Roofs and Walls

# Italian know-how for vertical green

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#### **VERTICAL GREEN GUIDELINES PROCESS**

# **Guidelines development path**



1) AIVEP group for the draft version, in collaboration with UNI (*Italian standards organization*)

2 round table with AIVEP member companies interested in contributing

3 update to all AIVEP members



#### **VERTICAL GREEN GUIDELINES**

A dynamic document, more than a picture of the state of the art.

Not a vademecum, but a step of deepening through stakeholders exchange, with the aim to raise the bar towards technical performances and ecosystemic benefits.

The final step of the process will be to achive the UNI national legislation.



rampicanti con sostegni

#### fioriere su più livelli





stratigrafia continua

#### **VERTICAL GREEN GUIDELINES CONTENTS**

# Subjects of guidelines and subsequent UNI standard

- Definitions, terminology about vertical green
- Functions and performance for the different categories e.g. energy saving, air cleaning, ecological compensation, management aspects
- Design criteria in a broad sense from components, to the key factors, up to control and management
- Classification of categories and types of vertical green
- Requirements and good practices for execution and assembly
- Indications for control and management of the different categories information for simplified activity, even in case of greenkeeper turnover





## VERTICAL GREEN GUIDELINES ROLE

A powerful development tool to create new opportunities for the entire stakeholder chain

DESIGNERS	ightarrow design for specific performances with coherent parameters and detailed specifications
CLIENTS	→ objective quality guarantees and protection in case of disputes
INDUSTRIES	→ research and development for new performing components
BUILDERS	→ segmentation of the offer according to new codified categories
MAINTENERS	→ precise indications to modulate the service
PUBLIC INSTIT.	→ criteria for inclusion in green areas, cost-benefit analysis, Life Cycle Assessment
RESEARCH TEAMS	ightarrow lines of investigation to improove performance knowledge
EVERYONE	→ unambiguous terminology also at international level

#### NATURALISTIC FUNCTION

Flora and fauna conservation to integrate natural ecosystems

#### Scientific approach

Choice of the key species for the local echosystem Evaluation of necessary conditions Choice of the vertical green methodology



Regional plants blacklist check







# Possible incompatibility of native plants with the aesthetic and maintenance



#### Lessons learned

There is a conflict between creating a wall that is both attractive and green all-yearround, and one that is biodiverse. To achieve one aspiration, the other must be at least partly compromised. Technological advances in living wall construction and irrigation, combined with well-informed plant choice, make attractive green walls easily attainable these days. (For example, emitter pipes combined with capillary mats ensure more even water coverage than weep-hose systems, while deeper, tilted tray cells hold more moisture for Individual plants.

Achieving biodiverse living walls is more complicated. We have observed through this study that applying cultivated native plant species does not necessarily bring about biodiversity. Sufficient time and resource is required to research and select the plants. For example, fast-growing drought-tolerant plants should not be associated with less competitive species that will be overtaken in time.

Allowing colonization and succession by nearby native species is favourable and so too is seasonality, yet both will provide patches of brown and decay. Gary Grant, of Green Roof Consultancy Ltd., and original AECOM design team member says, 'There is a problem establishing native species in natural associations to provide year-round uniformity of appearance'. Certainly, conditions that favour biodiversity can be at odds with what most people consider 'attractive.' Until the general population's aesthetic changes, it is probably best to accept that one goal — either attractiveness or biodiversity — will take priority over the other.

#### **CLASSIFICATION BY MANAGEMENT NEEDS**

Different design for specific goals

Priority objectives determine the project and management profile



## SYSTEM WATER EFFICIENCY

## Vertical green does not collect rain and is totally dependent on irrigation

WATER EFFICIENCY =



Water cycle contribution

Air and surface refreshment (energy saving)

**Evapo-transpiration** = water income volume - gravity water lost in drains

#### How to improve efficiency

- --> widespread distribution, from module by module up to plant by plant
- --> short irrigation times (frequently but in small amounts)
- --> matrices that retain humidity (and air for roots health)
- --> calibration through sensors, to water only when necessary
- --> possible water recycling





dripline arrangement



WATER CONSUMPTION ANALYSIS - GREEN WALL 'AUTOSILO DEL BUONCONSIGLIO' IN TRENTO (ITALY)





summer and winter look

#### **INVESTIGATION TO IMPROOVE PERFORMANCE KNOWLEDGE**

Evaluating of the environmental, economic, and social benefits of green envelopes in dense urban areas

Inps Green Facade Pilot Project Genoa, Italy



EXTERNAL SURFACE TEMPERATURES (from May to September) in *presence* or *absence* of vertical green



Katia Perini et Al.







<u>AIR CONDITIONING ENERGY SAVING</u> from temperature mesures inside the wall Comparison *with* or *without* vertical green



Energy demand of building without and with VGS.

Month	Air extracted from outside ['C]	Energy demand without green [kWh]	Air extracted behind vertical greening system [°C]	Energy demand <u>with</u> green [kWh]	Delta KWh [kWh]
2015					
June	26.5	2935.0	21.3	726.0	24.7
July	29.8	4637.0	24.6	2265.0	48.8
August	27.3	3344.0	22.7	1257.0	37.6
September	23.0	1326.0	19.2	202.0	15.2
TOT 2015		12242.0		4450.0	7792.0
2016	10000				
June	25.6	2537.0	22.6	1225.0	48.3
July	23.8	1900.0	21.7	986.0	33.6
August	21.3	706.0	18.3	123.0	4.2
September	23.2	1412.0	21.1	605.0	20.6
TOT 2016		6555.0		2939.0	3616.0
2017					
June	22.2	1061.0	20.7	540.0	50.9
July	25.6	2721.0	23.7	1855.0	68.2
August	26.3	2888.0	20.1	372.0	12.9
TOT 2017		13225.0		5706.0	7519.0

#### **AIR QUALITY IMPROVEMENT**

Quantification of air quality improvement PM collecting capacities

#### Inps Green Facade Pilot Project - Genoa, Italy



#### Quantification of particles absorbed on different species leaf epidermis



Number and size (µm) of particles in 1 mm2 for *Hedera helix, Cistus jessamy beauty, Phlomis fruticosa, Rhyncospermum jasminoide*, based on 100x, 250x, 500x magnifications















#### **EUROPEAN PROGRAM CLEVER CITIES HORIZON**

## led by Hamburg, London and Milan

it aims to drive a nature-based urban transformation for sustainable and socially inclusive cities



# PEOPLE IN CLOSE CONTACT WITH VERTICAL GREEN

#### Green wall on the bus depot ATM (municipal transport company) – Milano 2022

CLEVER Milano INTELLIGERZA NATURAL

funded by Milan Municipality, it's the first CLEVER Cities green wall in Milano

located in a busy avenue of a run-down neighborhood, it is focused both on social and environmental performance



#### **DESIGN CHOICES FOR ATM GREN WALL MILANO**

Ambition to create a real NBS, sustainable, for the people and for the ambience

Performance monitoring and research by CLEVER Cities Milan team

#### EASY BALANCE MAINTENANCE

reliable, tested, resilient varieties of plants, in a free evolution composition high performance fertirrigation system and sensors for remote monitoring and management counter for the outgoing flow (flowmeter) medium effort maintenance (level 3 on the scale from 1 to 5)

IN CLOSE CONTACT WITH PEOPLE designed together with neighborhood associations (co-planning) left at disposal of citizens, to check their reactions

FOCUSED ON ENVIRONMENTAL PERFORMANCE removal of gas pollutants and particles also during the winter

AESTHETIC IMPACT although not the priority, it is a consequence of the stability of evergreen vegetation and seasonal flowering

- ← investigation of the neighborhood's experience by Clever Cities Milano team
- Environmental performance monitoring by Politecnico di Milano

## ENVIRONMENTAL MONITORING AND COLLECTION OF PARTICULATES

The wall is 75m long and 8m high, with ideal proportions and position to collect particulate Politecnico di Milano will carry out environmental monitoring and leafs analysis



#### ATM GIAMBELLINO GREENWALL VEGETATION

plant development in August 2022, three months after installation







aolo Pignataro design







# ATM GIAMBELLINO GREEN WALL SUMMARY SHEET



Link.paolopignataro/atm-green-wall

#### **DATA SHEET**

PROJECT: first project of Greenwall Clever Cities Milan - bus depot Giambellino

LUOGO: via Giambellino 121, Milano - Italy

**DESIGNER**: Paolo Pignataro. Technical and aesthetic design, tender specifications, post-tender executive adaptations, construction management, testing, and management supervision.

CLIENT: ATM Azienda Trasporti Milanesi S.p.A.

**CO-DESIGN:** ATM, Designer, Neighborhood associations MILO.Lab, Team Clever Cities Milano, Milan Municipality, Ambiente Italia Srl, Cooperativa Eliante, Politecnico di Milano and Fondazione Politecnico.

**PROJECT HISTORY**: Co-design from November 2020 to January 2021. Design from January to April 2021. Milan Municipality Call BE2 in February 2021. Supply Tender from April to September 2021. Construction activities from October 2021. Greenwall testing in May 2022

**DIMENSIONAL DATA:** 350 m<sup>2</sup> of vertical greenery on a building facade 8m high and 75m long (600 m<sup>2</sup> minus 100 m<sup>2</sup> of windows and 150 m<sup>2</sup> of communication boards)

#### **IRRIGATION SYSTEM MAIN FEATURES**

Fertilization and pH correction system; self-compensating driplines for underground; PLC control and data logging, connected to water flow meter and sensors for environment monitoring; outgoing water meter, to improve the efficiency of irrigation water; remote management via WI-FI.

#### **BOTANICAL COMPOSITION**

More than 10,000 plants of the following varieties: *Aspidistra elatior, Bergenia cordifolia* 'purpurescens', *Campanula poscharskyana* 'Blue', *Cryptomeria japonica* 'Little Diamond', *Deschampia cespitosa* 'Scotland', *Geranium x cantabrigiense* 'Karmina', *Hedera helix* ('Hibernica', Hibernica mini', 'Gold Child'), *Heuchera americana* 'Dales Strain', *Hydrangea quercifolia* 'Snow Queen', *Iris japonica, Juniperus communis* 'Repandens', *Liriope muscari* ('Majestic', 'Evergreen Giant', 'Silvery Sunproof'), *Lonicera nitida* 'Maigrun', *Mahonia aquifolium* 'Apollo', *Polystichum polyblepharum, Sarcococca humilis, Taxus baccata* 'Repandens', *Trachelospermum angustifolia, Vinca minor* 'Big Blue', *Waldsteinia ternata*.







# **HANKS**



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