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Creating Landscape on a Roof

Georgi, Neratzia Julia

þ Landscape Architecture Department Drama Greece

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Technological Educational Institute of Kavala – Greece

Creating Landscape on a Roof

Proceedings of the 4th International
Landscape Workshop
Drama – Greece 11-13 May 2009



Landscape Architecture Department Drama – Greece





4th International Workshop Landscape Architecture
May 2009

“Creating Landscape on a Roof”

Technological Educational Institute of Kavala

In collaboration with

Istanbul Technical University – College of Architecture
Landscape Architecture Department

Editor

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“Creating Landscape on a Roof”

Forward

Declan Rafferty ()*

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This publication was prepared to document the proceedings of the 4th International Landscape Workshop at the Department of Landscape Architecture at the Technological Educational Institute of Kavala – Drama in May 2009. The publication is set out in two sections with the first section covering the presented papers from the participants of the conference and the second part showing the students design works.

The theme “Creating landscape on a roof” was the chosen topic of study. A series of lectures and seminars were presented to a gathered audience of students from Greece, Turkey, Cyprus and Romania. The lectures delivered by local and international guests, opened up discussions on related topics from pure aesthetics to climatic benefits, through to creating new elevated ecosystems for the city.

The Municipal Enterprise Short Film Festival building in Drama was selected as the case study site. Students began by vis-

iting the site to gather data and to carry out an evaluation of the site. Students then were divided into smaller groups and set about doing site analysis before exploring design concepts. The groups carried out their work in the Design and CAD studios at the Department of Landscape Architecture closely working with the invited professionals and academics. The students worked intensively over a two day period exploring and developing their design ideas. The completed design work was presented in an open forum to the tutors, guests and their student peers. These critique sessions generated a dynamic energy that enabled an exchange of ideas from all involved.

The Workshop not only produced a most interesting and valuable discussion on “creating landscape on a roof” but also helped to push the boundaries in landscape design and raise awareness of its environmental benefits in our ever expanding cities.



Preface

Julia Georgi ()*

() (PhD A.U.Th., MLA Univ. of Newcastle Upon Tyne) Ass. Prof. of Technological Educational Institute of Kavala, Landscape Architect, Consultant Prof. of Hellenic Open University, jgeorgi@tee.gr*

The Department of landscape Architecture at the Technological Educational Institute of Kavala – Drama has for the last three years successfully organised International Landscape Workshops, attracting academics, professionals and students from Greece, Turkey, Romania, Cyprus, Ireland, France, Sweden and England.

These workshops have now become a permanent fixture and each year focus on a topical landscape theme.

The theme of the 4th International Landscape Workshop from Greece 11-13 May 2009 titled “Creating landscape on a roof” was a direct response to concerns relating to the rapid loss of green field lands due to over development and damage to the natural environment.

Invited guests participated by presenting a series of papers and lectures relating to green roofs from an international perspective.

Students and tutors from the Department of Landscape Architecture at the Technological Educational Institute of Kavala – Drama, alongside their counterparts from Istanbul Technical University – Landscape Architecture Department, College of Architecture collaborated on designing a roof garden on the newly built headquarters, (designed by Architect Fatouros) where the Municipal Enterprise of International Short Film Festival in Drama is based. The building is located in the natural district of Aghia Varvara, nearby the centre of Drama. The book is divided in two sections: the first section includes the papers and lectures presented by the guests and the second section shows casing students works.



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Acknowledgements

To professor Thanasis MITROPOULOS President of the Technological Educational Institute of Kavala, for his support in funding the International Landscape Workshop.

To Associate Professor Gregor CHATZIPHILIPPIDIS, the Director of the Department of Landscape Architecture at the Technological Educational Institute of Kavala – Drama, for his valuable support and participation in the workshop.

To Hayriye ESBAH TUNCAY, Declan RAFFERTY and Eleni ANTONARA, members of the Scientific Committee, for their encouragement and valuable advice.

To Elpiniki CONSTANTINIDES, Achilleas KAMPOURIS, Eleftheria SYLEOUNI, Maria DIAMANTI members of the Organising Committee for their dedicated and tireless work.

To Associate Professor Nikos SPITALAS, Associate Professor Maria KONSTANTINOY, Associate Professor Athanasios STILIADIS, Assistant Professor Lazaros SECHIDIS, the Scientific Staff from the Department for following the lectures and supporting the event.

To Nikos ELEFThERiADIS Emeritus, professor from the depart-

ment, for his valuable advices and his participation, which was an honour for us.

To Prof. Ahmet YILDIZCI, Head of the department at ITU and Res. Ass. Gulsen GULER for helping with the organization of the Turkish group.

To Marcelle LOIZOU, Landscape Architect, for her valuable work of the Supervision of the English Texts.

To all the sponsors of the workshop for their generous support.

To the students from the Department of landscape Architecture at the Technological Educational Institute of Kavala – Drama and Istanbul Technical University – Landscape Architecture Department, College of Architecture for their dedication and hard work during the workshops (see the names at the end of the book).

To all the staff of the Department for their administration support and to all the participants for following part of the whole event.



Part 1

Papers

INTRODUCTION

Julia GEORGI

ROOF GARDENS IN TURKEY

Ahmet Cengiz YILDIZCI, Gülşen GULER

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Andrew MICHAEL CLEMENTS





INTRODUCTION OF ROOFGARDENS: A NEW GREEN NETWORK

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The aim of this workshop is to create an ecological design that would promote nature and also be aesthetically pleasing. This would be done with public participation, helping to raise public awareness and help kick-start a new green network in crowded cities.



Roofgardens: A new Green Network

The creation of roof gardens help to protect the environment: by using recycled products on one hand we relieve disposal sites and on the other hand we give nature the chance to re-conquer space in the crowded cities.

Apart from the attractive appearance of a Green Roof, there are also a lot of solid economical and ecological benefits.

Green Roofs are worth being installed – from small surfaces on garages or car parks up to large industrial surfaces.

These criteria for green roofs are:

- Ecological
- Economical
- Qualitative
- Functional
- Phyto-social climatic
- Land and technical - architectural.

Roof Gardens are categorized into three types according to their characteristics and their depth of soil for the plants' root systems.

These three types are:

The Extensive, which is the simplest type of Roof garden and



“Creating Landscape on a Roof”

is intended only for watching without being available for visiting. In this type of Roof gardens, the only plants that can be visited are the ones that have a small root system. This type of Roof Garden does not over burden the static of the building.



Plan of Extensive greenroof at 1st and 2nd Gymnasium of Municipality of Zografou designed by Julia Georgi, Alexandru Oprita and Achilleas Kampouris aiming to the environmental education at the rooftop



3D design of the 1st and 2nd Gymnasium of Municipality of Zografou designed by Julia Georgi, Alexandru Oprita and Achilleas Kampouris

The Semi – intensive, which is a developed form of the Extensive type. This type of Roof Garden is available for visiting but it also has small plants and the bigger ones are being planted into big flowerpots. This type of Roof Garden does not over burden the static of the building.



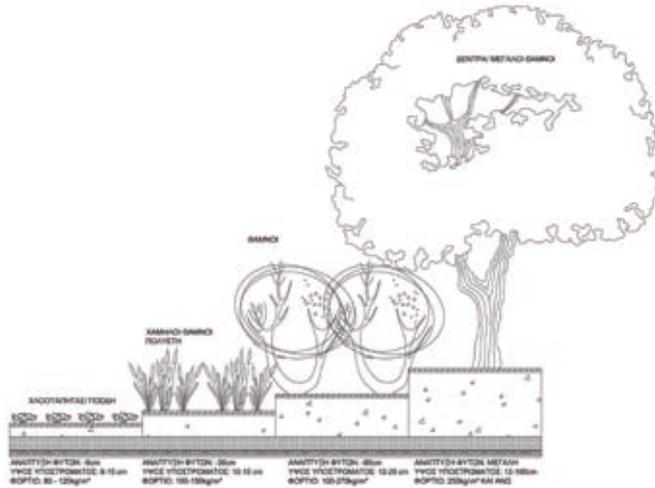
Intensive greenroof of the Sant George square located at the top of a car – parking at Zografou Municipality designed by Julia Georgi and Alexandru Oprita in order to improve the aestetel quality of the area and the microclimate

The Intensive, is the most expensive and the heaviest type of Roof Garden construction. This type allows the planting of plants straight to the soil. The application of this type on a building requires a study for the static sufficiency of the building.

The types of construction of green roofs are selected each time according to the following two factors:



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Differences between the soil depth of each type of Roof Garden Construction

1. The design of the city and the aesthetics
2. The building structure

There are several ways of installation of vegetation with the usage of industrial systems. The three most popular types are presented below.



Connecting Systems



Complete Systems



The pro – cultivated planted carpets

During the last few years, one more type of structure of classification of Roof gardens' category is that of vertical planting.

These plantations are mainly found abroad and consist of a variety of plants that are specific construction affixed to the walls. The plants are either installed or placed in climbing steps.

The advantages of such a construction are:
We charge additional vertical cargo building.
The financial requirements of this structure are much lower than those of planting room.

The type of vertical plantings is classified into four sub-categories:

- Green facades
- Passive walls
- Active walls
- Vertical wildlife habitats

Another type of a Green Roof, which constitutes one category on its own, is the brownfield Greenroofs.

The brownfield greenroofs are built with material transferred from the surrounding areas from broken tiles or concrete or demolition debris. Natural regeneration will occur



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Active walls



Green facades



Passive walls



Vertical wildlife habitats

without the aid of planting and seeding, attracting prevailing species, plants, insects and birds. The brownfield greenroofs are particularly valuable because they keep the biodiversity and natural succession avoiding desertification.



The brownfield greenroofs on the River Thames in Central London

All the above mentioned types and ways of planting – constructing green roofs have no meaning if we do not take into consideration the sustainability principles of designing green Networks.

The designers should always have in mind the:

Mechanisms of nature.

Biodiversity.

Cost benefits.

Connection with the urban and Periurban.

Development overlapping subnets to operate independently.

Reconstruction of the built-up areas, the protection of unstructured and recovery of abandoned land.

To conclude, the ecological operations that roof gardens offer to a building are summarized below:



“Creating Landscape on a Roof”

The exploitation of empty available spaces.
The maximization of roofs' life duration and the offer of insulating protection in the roofs.
The saving of energy by decreasing the needs for air conditioning and heating.
The contribution to the reduction of dust and clouds by filtering the atmospheric pollutants with their vegetation.
The contribution to a great degree in the reduction of noise pollution.
The contribution to the increase of oxygen in the cities.
The contribution considerably to the reduction of flow of rain waters in the drainage systems.
The creation of ecosystems in the urban regions and the output of natural environment for plants and animals.
And finally the improvement of microclimate and the airing of the cities.

In Toronto Food policy Council is preparing a program for vegetable production in roofs. An example of a productive garden with herbs is the garden of the Hotel “Vancouver’s Waterfront” where restaurants Hotel procure herbs from the garden of the roof (Peck, 2003). This reduces the production, transportation, maintenance and provides work and recreational opportunities to residents of cities.

In West Street - Sheffield the roof gardens were met in a very original way. They were constructed on the Bus Shelters.

The aim was to provide a green roof in small public spaces and



The productive garden with herbs of the Hotel “Vancouver’s Waterfront”

create an attractive environment that will absorb pollutants and improve the microclimate. By now, the same company planted 8000 m².



Bus Shelters. West Street – Sheffield



“Creating Landscape on a Roof”

ROOF GARDENS IN TURKEY

Ahmet Cengiz Yildizci (*), Gülşen Guler (**)

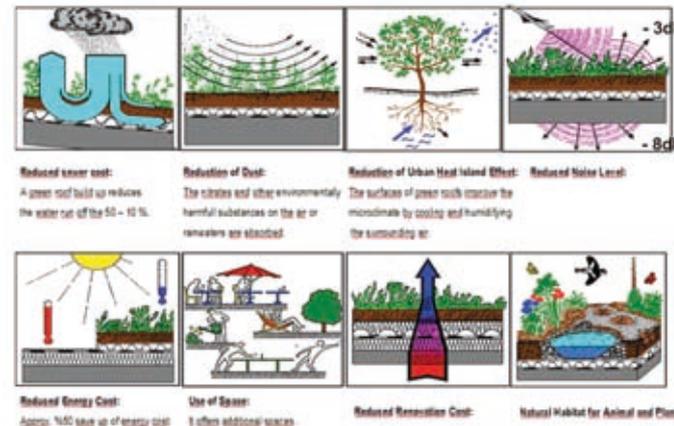
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Abstract

Increasing urbanisation and scarce consideration for natural resources have led to a globalisation of urban environmental problems. Irrespective of the matter – whether bottlenecks for storm water management, urban heat islands, air pollution, or loss of the quality living and life - green roofs can contribute their part to solving these problems. As natural construction concepts, green roofs have the advantage that they can offer problem-solving measures and can also be individually adapted to local conditions. So, we can state green roofs hold a decided position in sustainable urban planning. In particular, Le Corbusier discovered the advantages of reinforced concrete to enabling them to build flat roofs that could be used and landscaped. In 1980s the idea of covering buildings with soil in order to create temperature buffer and retain rainwater grew rapidly. As a case, Turkey newly is aware of the significant importance of green roofs and has been witnessed roof gardens in last 10 years. This paper explores green roof projects in Turkey.

Introduction

Fast Urbanization all over the world has resulted in the loss of green lands. Natural surroundings that should normally exist have been replaced by concrete buildings. Air pollution has become a major worldwide problem. Green Roofs constitute the ideal solution for offsetting the loss of nature. Green Roof helps twice to protect the environment: by using recycled products on the one hand relieving disposal sites and on the other hand giving nature the chance to reconquer space in the crowded cities. Apart from the attractive appearance of a Green Roof, there are also a lot of solid economical and ecological benefits. Green Roofs are worth being installed – from small surfaces on garages or car parks up to large industrial surfaces.



Picture 1. The Benefits of Green Roofs



“Creating Landscape on a Roof”

Green roof systems for extensive and intensive landscaped roofs?

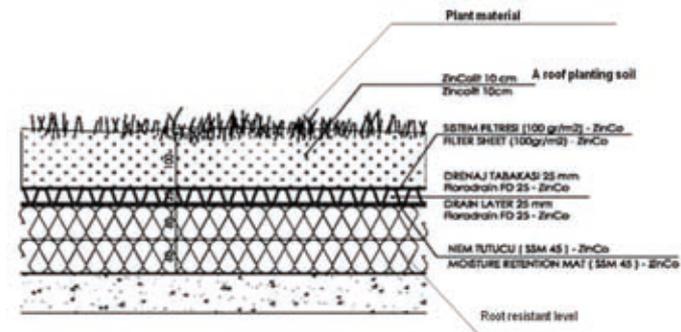
It has been already distinguished between intensive and extensive green roofs whereby most of the statements made concern intensive green roofs, since little was known about extensive green roofs at this point. Extensive green roofs was only focused on as a central theme at the beginning of the 1980s. As the ecology movement picked up the momentum, the wish was heard for ‘more nature on the roof’ illustrate the way of thinking. In addition; intensive roof gardens are more widely spread.

In Intensive landscaping: If there is enough load bearing capacity it is possible to realize roof gardens. From lawn and demanding shrubs to bushes even trees and ponds in combination with driveways and terrace surfaces. The load bearing capacity has to be: 300 kg/sqm.

In extensive landscaping: Extensive landscaped roofs are an ecological alternative for conventional surface protections such as gravels. The load has to be supported by the roof is less than 100 kg/sqm.

A roof planting soil which is adapted to the plant level. The base of each roof planting soil is “Zincolit” which is completely mineral material on the basis of crushed clay bricks, enriched with the organic material Zincohum.

Filter and Drainage levels: Prevents fine particles from being



Picture 2. Green Roof Fundamental Build-Up Levels

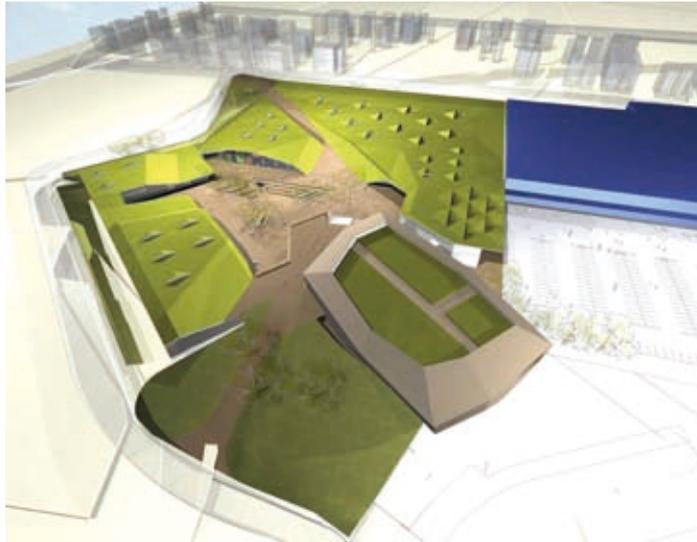
washed out of the substrate soil. The surplus-water is drained off through the channel system on the underside. Special holes ensure the evaporation and the necessary ventilation.

GREEN ROOF EXAMPLES FROM TURKEY

1. Meydan: The Meydan retail development performs as an efficient retail complex. It is located in a suburban area on the Asian sector of Istanbul. The different retail spaces are clustered together and parking is placed underground. It is liberating the ground entirely for a large urban square in the centre of the scheme. The central square is activated through a number of pedestrian routes, linking the underground car park to the ground level and accessible from the wider city context through two new routes across the roofs of retail spaces. All roofs are connected to the surrounding topography at several points and designed as gardens with extensive vegetation.



“Creating Landscape on a Roof”



Picture 3. 3D View from Meydan Retail Complex

The roof is fitted also with roof lights that provide daylight and ventilation to the inner spaces (picture 3).

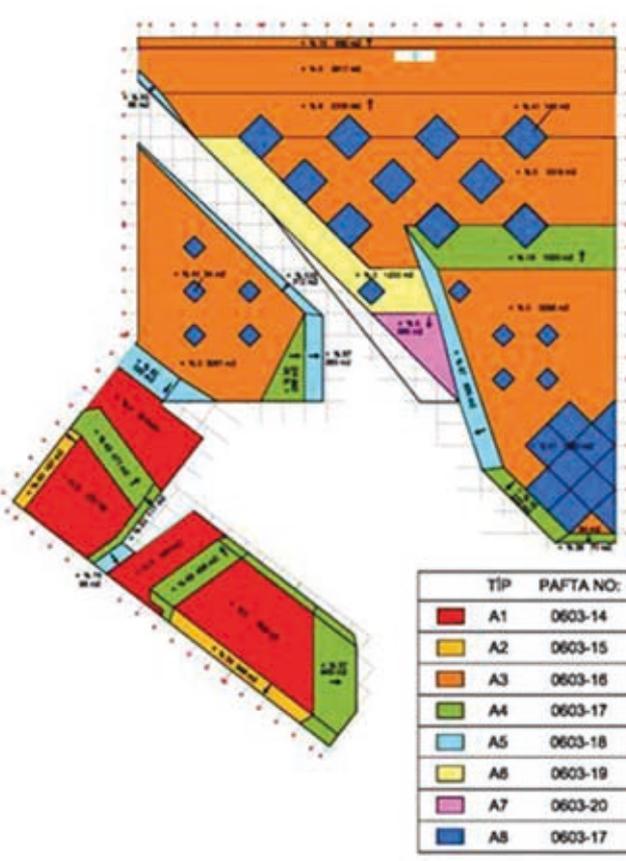


Picture 4. 3D View from the Square of Meydan Retail Complex

All the surfaces of the project that are not planted with greenery, both elevations and floor surfaces, are clad or paved with the same material: earth-coloured ceramic tiles that incorporate various degrees of perforation depending on functions and uses behind (picture 4).

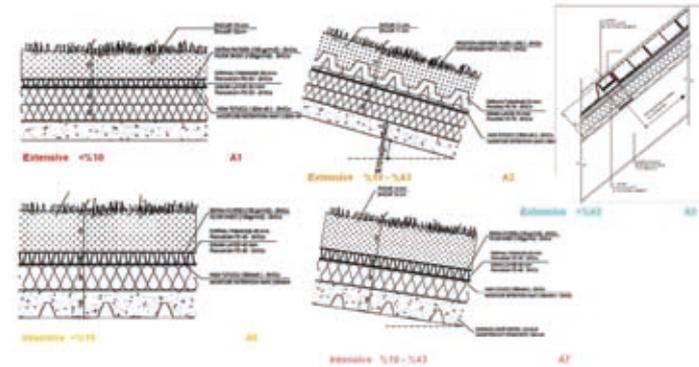


“Creating Landscape on a Roof”



Picture 5. The construction plan according to the slopes

Meydan project was implemented according to the different slopes and the dense of the vegetation. In different slopes, different layers were used that is shown in picture 6.



Picture 6: Different fundamental layers that implemented in Meydan Roof Garden



Picture 7: Implementation process in Meydan



“Creating Landscape on a Roof”



Picture 8: View from Meydan



Picture 9: View from Roof Garden of Kanyon

2. Kanyon Shopping Center and Residence:

Kanyon is a complex building that consists shopping centre, residential buildings, office buildings. It is located on the new central district of Istanbul, on Sisli-Levent axis. It has a connection of metro station and car parks. There are car parks under all shopping center whereby on all the residential and office buildings there are roof gardens.



Picture 10: View from the base floor and the roof garden of Kanyon

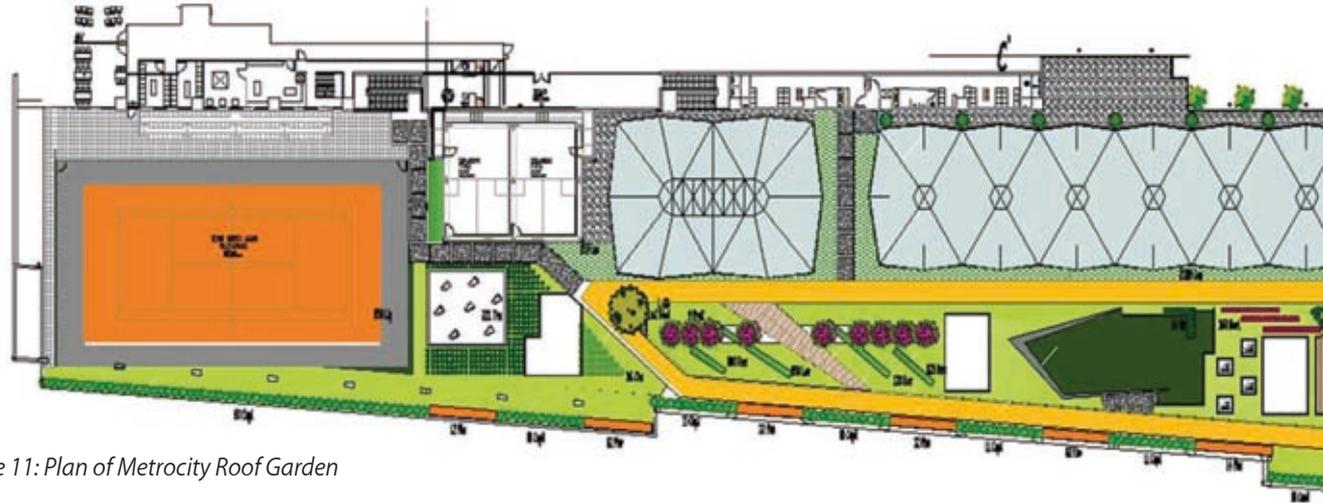


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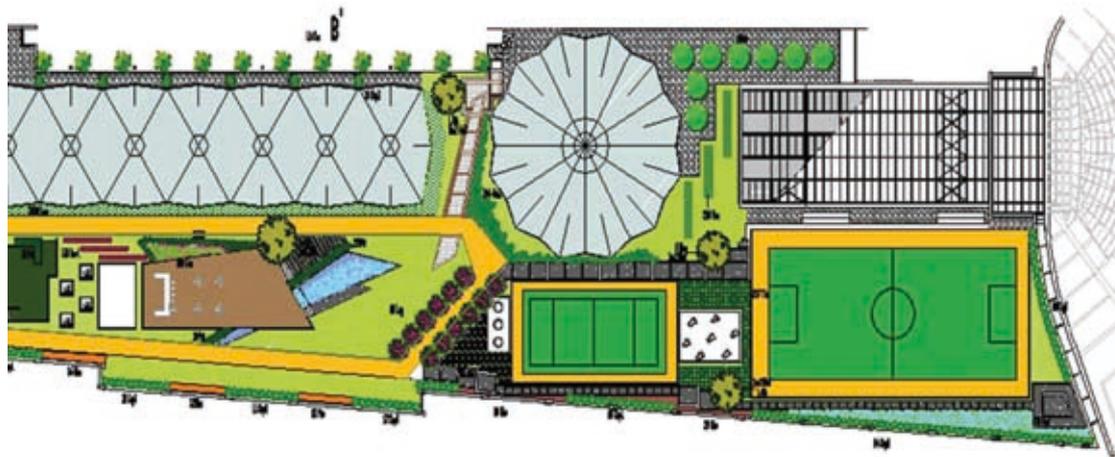
3. Metrocity Shopping Center

Metrocity is also shopping center and residential building. It is also on the same axis as Canyon. It was designed by Prof.

Yildizci & its group. Spa part, sport center and their garden can be seen in picture 11.



Picture 11: Plan of Metrocity Roof Garden



Picture 12: Plan of Metrocity Roof Garden



“Creating Landscape on a Roof”

4. Four Seasons Hotel in Beşiktaş

Four Seasons Hotel is located in Beşiktaş and on the Bosphorus. There is car park under the entrance square of the hotel. In the concept of the projects, all the plants are used in the pots in order not to have problem about the soil.



Picture 12: View from Four Seasons Hotel

Conclusions

All over the world, people are becoming more and more interested in landscaped roofs. As all we know; roof gardens have been constructed in different cultures since the ancient times. Although landscaped roof have been around for hundred of years, Turkey is very newly aware of its importance about the outdoor living, recreational needs and ecology. In the paper, above it is mentioned about the roof gardens in Turkey. Two of the examples are done by Yildizci Group, one of them is done by FOA, one is done by Trafo Architects.

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www.f-o-a.net

www.onduline.com



EXPERTISED TECHNOLOGY ON GREEN ROOFS

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INTRODUCTION

As Green Roof is comprehended a loft which is covered by Vegetation which is developed under control and has energy, environmental and economic profits. The specialized DIADEM products are disposed in various types, depending on the uses and requirements that each project has. Including waterproofing and root resistant membranes, separation sheets, specific light substrates, underground irrigation system, inspection boxes, grills, safety technology and photovoltaic supports.

GREEN ROOF BENEFITS

1. Maximization of the utility and value of the building – Utilization of free spaces
2. Maximization of the roof's shelf life – Roof's insulation protection
3. Energy saving – Air-conditioning and heating needs decrease
4. Noise pollution decrease
5. Atmospheric pollution filtering – dust and haze decrease
6. Ecosystem recreation in urban areas – Natural environment for plants and animals
7. Microclimate and ventilation enhancement
8. Oxygen increase and CO₂ decrease
9. Waterfall decrease in the sewage system



ANWB Headquarter, Den Haag, Holland



“Creating Landscape on a Roof”

TYPES

EXTENSIVE GREEN ROOF (DIADEM 150)

An ecologically sound and economic green roof system that provides a meadow effect, which requires only low maintenance.



- SKG-Vegetation
Sedums-Herbs-Grasses
- SIM-12 Multi-layered Extensive Soil
- VLF-150 Filter Fleece
- DIADRAIN-25 Drainage and Reservoir Board
- VLU-300 Protective Fleece
Saturated weight: ca .150

SEMI INTENSIVE GREEN ROOF (DIADEM 350)

Ideal for the creation of an outdoor living space. This garden roof system utilizes basic plant types, which require more maintenance than the extensive roof.



- GSG-Vegetation
Grasses-Shrubs-Small trees
- SEM-12 Multilayered Intensive Soil

- VLF-200 Filter Fleece
- DIADRAIN-40 Drainage and Reservoir Board
- VLS-500 Protective and Reservoir Fleece
Saturated weight: ca. 350 kg/m²
Total height: ca. 30 cm

INTENSIVE GREEN ROOF (DIADEM 750)

An intensive green roof system, which may include an irrigation system. Opens up practically all the possibilities of normal ground-level gardening.



- SGRB-Vegetation
Shrubs-Small trees-Lawns-Trees
- SEM-12 Multilayered Intensive Soil
- VLF-200 Filter Fleece
- DIADRAIN-60 Drainage and Reservoir Board
- VLS-800 Protective and Reservoir Fleece
Saturated weight: ca. 750 kg/m²
Total height: ca. 84 cm



FiltzWilliam Hotel, Dublin

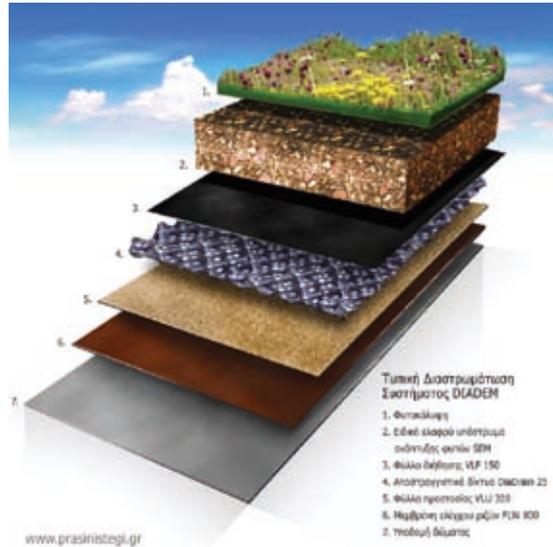


Great Britain - London



“Creating Landscape on a Roof”

GREEN ROOF'S ANATOMY



1. Insulation
2. Root barriers
3. Protection sheet (VLU)
4. Drainage system (DIADRRAIN)
5. Filter fleece (VLF)
6. Growing medium\
7. Vegetation

DIADEM PRODUCTS

The specialized DIADEM products are disposed in various types, depending on the uses and requirements that each project has. Including waterproofing and root resistant membranes, separation sheets, specific light substrates, underground irrigation system, inspection boxes, grills, safety technology and

photovoltaic supports.

The products of DIADEM are considered pioneering regarding the possibilities of application and well-known for the quality of materials as they suggest new and innovative solutions.



Diadrain-25



MDE-60



VLF-150



VLU-300



FLW



KLS-ES 8/12



FLG-30/50 line system



KSE-10



SLH-50

GREEN ROOF EXAMPLES FROM GREECE (DIADEM)

1. M.O.D S.A. (Ministry of Finance)

Green roof on the eighth floor-building of MOD S.A, total surface 250 m².



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Profits: Energy saving, natural ecosystem, air pollution filter, use from employees.

Total surface: 250 m²

2. HSAP S.A. (Ministry of Transport)

The first public building with a green roof in the center of Athens.



Profits: Energy saving, natural ecosystem, air pollution filter, use from employees.

Surface: 450 m²

3. Private roof in Filothei



Green roof construction in Filothei

Profits: Amenity space and aesthetics, energy saving, private use.

Total surface: 100 m²



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Completed green roof in Filothei

4. Private roof in Livadia



Herbal green roof in Livadia

Profits: Energy saving and herb production for private use
Total surface: 100 m²

5. Green roof construction stages at the Hotel Aldemar-Olympian resort



Root barrier



Protection sheet



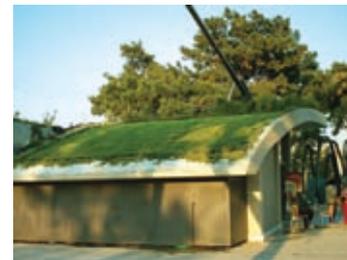
Drain and reservoir element



Filter fleece

Profits: energy saving
Total surface: 115 m²

6. Sloping green roof-Everest-Redi





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7. Vertical garden – Green Design Festival, Syntagma Sq.



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PLANTED ROOFS: OPEN AIR ROOMS – CLIMATIC HOODS

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Abstract

It is all about an effort to reinstate anthropocentrically the attitudes towards the design of our built environment. Instead of idolizing technology, computers and financial profits architectural thinking should reinvent Vitruvius, Alberti, Palladio and try to understand their classical precepts. Buildings are for human beings and should be treated as human habitats. A high rise apartment building should be structured as a human body: having a base, a body and a sheltering upper end, meeting the sky.

Planted roofs may revive all traditional Mediterranean uses of them as open air living rooms (vital social places) and thermal conditioners (ecological climatic covers).

The ascertainment of lack of green (that is to say planted extents) in the majority, if no in the entirety, of the big urban agglomerations of Modern Greek territory touches upon the limits of commonplace henceforth. The greed of “antiparochi”

prisoner of the pandemic of concrete deformed, ostracized and ruined each planted extent, suppressing in the daily practice an irreplaceable for the human community priority: the direct relation with the nature even in the her planting form.



from <http://gazette.unc.edu/archives/07oct03/photos.html>

In the later decades of twentieth century the snobbish and extreme use of technology with her irreversible repercussions in nature they brought in the surface of world common knowledge frightening fears for befalling annihilation of friendly for the survival of human good climatic conditions. The terror for this climatic Armageddon mobilized individual and collective behaviours towards the constitution of a worldwide and multi-



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form ecological movement for the protection of viability of our planet. Important component of this world resultant constitutes also the recently developing propensity to the planted roofs.

After the completion of Second World War and the civilian clash the charge of urbanism brought in our place the ready-reckoner of “antiparochi” and horizontal property. The building know-how, the interests of developers, but also the repeated electioneered changes of building regulations imposed the absolute sovereignty of block of flats and horizontal level roof (loft, terrace).

Today, this desert of roofs in our urban centres reflects her barren surfaces in the atmosphere, affixing aerials, mechanical installations and abandoned objects that replace the fertile ground that her construction deforested and the social contact that her apartment anonymous privacy turned to ruins.

Nevertheless, the challenge for an alternative management of this enormous roof reserve of urban fabric has traditional historical solutions and also produces subsidized prospects.

From the marvel of Hanging Gardens in Babylon until the spectacular Ziggurats in Chaldea and the humble sleeping-roofs of the popular residences in the Mesopotamia, the planted lofts offered their aesthetic, ecological, functional and social contribution to the improvement of life quality in their environment.

However, even today the spread of ecological movement, the



culture of bioclimatic architecture, the preference of soft forms of energy and their support by national and international legislative regulations render positive the regard of future course of planted lofts.

On the other hand, the recapture of part of planted urban spaces that thoughtless and arbitrary building has destroyed is possible to be reconstituted on the roofs. The planted lofts absorb big quantities of solar energy, provide shade and coolness in the surface of loft, they decrease the big temperature fluctuations while they increase the thermal capacity of the loft. Besides they contribute in the reduction of noise pollution, the detention of dust and atmospheric pollutants, the lessening of the urban heat island effect, the alleviation of urban drainage system by absorbing rainfall, while simultaneously they provide shelter for the local fauna and flora but also for the invigoration of social relations of residents.



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other actions, the coming of frightening climatic changes. This attitude has begun to spring up from sources scattered in various regions of the Earth, weaving the swaddling clothes of a titanic work so that Earth remains the source of life and will not become a fragment of life lost in time. In the Arabic language the word “source” corresponds to the word “masdar”. Taking this word as her name and her obvious symbolism as birth motive, a city has been designed by the architectural office “Foster and Partners” and is under construction in Abu Dhabi. It will become an exemplary city with zero emissions of pollutants, zero quantities of litter and catholic use of soft forms of energy. Being programmed to be completed in 2016 the city of Masdar stands as the alternative ecological proposal to the publicity hunting and energy devouring building exaggeration that it has taken the Arabic Emirates while it wishes to become a prototype for world use.

The planted lofts offer, alongside with homogenous intentions and proposals (green walls, green towers, materials friendly to the environment, soft forms of energy, et al.) an effervescently developing alternative attitude of architectural planning, capable to immobilize, be it gradually, with the subscription of



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order to fill the “logos” (reason) and the “nomos” (law) of the “oikos” (habitat) of people with their didactic values. The works of Architecture owe to reconcile themselves with the climate, the materials, the scale and the spirit of place, and in order to do so their architects owe to think and to design ecologically, economically and anthropocentrically staying away from the cash models and the checks of vulgar architectural fashion.

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The increasing popularity of ecology, also strengthened by a world governmental policy of economic motives, has restored in the first line of choices the values of meter, order, proportions, friendly relation to the natural environment and people. Vitruvius, Alberti, Palladio and their precepts of Architecture return in



PLANT MATERIALS FOR GREEN ROOFS

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Abstract

Green roofs are important habitats in urban areas. In order to maximize the benefits and make the most of an investment, special attention should be paid to the selection of plant materials. This paper focuses on the use of plant materials for green roof gardens. Lists of plant materials for extensive and intensive green roofs are presented, though the possibilities are not limited to these species.

Introduction

The history of roof gardens goes back to ancient times. One of the earliest documented examples, the Hanging Gardens of Babylon, was built around 600 B.C. by the Chaldean king, Nebuchadnezzar II, as a consolation to his wife, who missed the natural surroundings of her homeland. Nowadays, we have much different reasons for having roof gardens. Because, our interaction with nature is scarce in dense urban environments, roof gardens presents a reasonable opportunity to make such connection. Moreover, energy efficient and sustainable design of our landscapes requires the utilization of roof tops as part of the green infrastructure of the cities.

A green roof is a roof partially or completely covered with veg-

etation and soil, or a growing medium, planted over a system of manufactured layers. Green roofs are also referred to as eco-roofs, vegetated roofs, living roofs. The use of the term is also appropriate if some form of green technology, such as solar panels or a photovoltaic module, or some environmentally friendly applications such as greywater treatments are incorporated. However, container gardens on roofs, where plants are maintained in pots, are not generally considered to be true green roofs.

The benefits of green roofs are well documented in terms of green space amenity, habitat for wildlife, air quality improvement, reduction of urban heat island (Getter and Rowe 2006, Oberndorfer et al. 2007), and food production (Green Roofs for Green Cities 2009). Other potential benefits include sound insulation (Dunnett and Kingsbury 2004), longevity of roof membrane (Porsche and Kohler 2003), and energy efficiency (Del Bario 1998).

In order to maximize the benefits, a green roof designer should consider the following criteria before starting planting design: design intent; the client’s needs and expected outcomes; budget and maintenance parameters; life expectancy of the green roof; access and safety issues; location; micro and macro-environments; exposure; humidity or dryness; maximum and minimum temperatures; medium weight, depth, and composition; and irrigation (Snodgrass and Snodgrass 2009).

Extensive and Intensive Green Roofs

Green roofs can be categorized as “intensive” or “extensive”.



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Picture 1. An example of extensive green roof: Meydan Shopping Mall, Istanbul, Turkey. Design by Foreign Office Architects. 1- central square, 2- vegetated steep slopes, 3- sod roof over a supermarket, 4- Sedum species and planting medium.



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Intensive green roofs require a reasonable depth of soil to grow large plants or conventional lawns, and are labour-intensive (requiring irrigation, feeding and other maintenance). Intensive roofs can be used for recreational purposes, hence easily accessible. Extensive green roofs, by contrast, are mostly self-sustaining and require only a thin layer of compost and minimum maintenance (yearly weeding or an application of slow-release fertiliser to boost growth). Extensive roofs usually are not accessible (except for maintenance purposes). A comparison of extensive and intensive green roofs are presented in Table 1.

Table 1. Characteristics of extensive and intensive green roofs.

| Characteristics | Extensive roof | Intensive roof |
|-------------------------------------|---|---|
| Purpose | Functional; storm-water management, thermal insulation, fireproofing | Functional and aesthetic; increased living space |
| Structural requirements | Typically within standard roof weight-bearing parameters; additional 70 to 170 kg per m ² (Dunnett and Kingsbury 2004) | Planning required in design phase or structural improvements necessary; additional 290 to 970 kg per m ² |
| Substrate type | Light weight; high porosity, low organic matter | Light weight to heavy; high porosity, low organic matter |
| Average substrate depth | 2 to 20 cm | 20 or more cm |
| Irrigation | Most require little or no irrigation | Often require irrigation |
| Maintenance | Little or no maintenance required; some weeding or mowing as necessary | Same maintenance requirements as similar garden at ground level |
| Cost (above waterproofing membrane) | \$100 to \$300 per m ² | \$200 or more per m ² |
| Accessibility | Generally functional rather than accessible | Typically accessible; bylaw considerations |

(Source: Oberndorfer et al. 2007, p.825)

Plant Materials for Green Roofs

Ideally, green roof plants should incorporate most of the following characteristics: low growth height; rapid growth, rapid spread; high drought tolerance; fibrous root as opposed to tap roots to protect roofing membranes; no special irrigation or nutritional requirements; low maintenance - trimming, weeding, feeding. Also, plants shouldn't generate airborne seeds in order to prevent the green roof plants invading other landscaping. Plant materials can be applied to green roofs by pre-vegetated mats or blankets; direct on-site planting of cuttings and/or seed or root plants; hydro-planting; or any combination of these methods.

Roof environments could be challenging for most plants due to decreased substrate thickness and direct exposure to sun, heat and wind. While the effects of heat stress are not as immediate as those of freezing temperatures, stunted growth and plant mortality can and do result from overexposure to heat (Snoodgrass and Snoodgrass 2009). Regional differences in the full sun hours per day also should be taken into consideration. Green roof plants should also have a long life expectancy to make a project cost effective. This eliminates the vast majority of annual and perennial plants associated with traditional gardens. Although some herbaceous perennials and annuals may be used as accent plants or for seasonal interest in carefully selected locations with an appropriately deep medium and proper irrigation, they should not make up the bulk of plants specified for an extensive green roof (Snoodgrass and Snoodgrass 2009). Potential plant lists for extensive/ intensive greenroofs are presented in Table 2 - 3.



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Picture 2. An example of intensive green roof: A residential area application, 1- Mesa Yanki Apartments, Istanbul, Turkey, Design by: Ata Turak, 2- mulch and plant materials used, 3- Mesa Yamac Apartments, Istanbul, Turkey, Design by: Ata Turak, 4- Plant strips used in the planting design.



“Creating Landscape on a Roof”

Table 2. Plant materials for extensive green roofs

| Name | Flower | Flowering time | Exposure | Notes |
|--|--------------|--------------------|---------------------|-----------------------------------|
| <i>Allium schoenoprasum</i> | Pink | March, April | Full Sun | Self-sowing |
| <i>Allium senescens</i> 'Glaucum' | Pink | April | Partial sun | Self-sowing |
| <i>Delosperma nubigenum</i> 'Basutoland' | Pink, Yellow | May, June | Partial sun | Cold sensitive |
| <i>Dianthus subcaulis</i> | White, pink | May, July | Full or partial sun | |
| <i>Drosanthemum floribundum</i> | Pink, Purple | April, May | Full sun | Cold sensitive |
| <i>Saxifraga sempervivum</i> | Pink | April, May | Full sun | |
| <i>Sedum acre</i> 'Aureum' | Yellow | May, June | Partial sun, shade | Cold hardy |
| <i>Sedum album</i> | White | May, June | Full sun | |
| <i>Sedum kamtschaticum</i> | Yellow | June, July | Partial sun, shade | |
| <i>Sedum reflexum</i> | Yellow | June, July | Full sun | |
| <i>Sedum sexangulare</i> | Yellow | June, July | Sun, Shade | Tougher than <i>S. acre</i> |
| <i>Sedum spurium</i> 'Fuldaglut' | Pink | September, October | Shade | Pinkish tinted |
| <i>Sedum spurium</i> 'John Creech' | Pink | July, August | Shade | Low growing habit |
| <i>Sedum spurium</i> 'Roseum' | Light Pink | June, July | Shade, sun | Low growing habit, cold sensitive |
| <i>Sedum sieboldii</i> | Pink | October | Full sun | |

Table 3. Plant materials for intensive green roofs

| Name | Flower | Flowering time | Exposure | Notes |
|---|---------------------|-----------------|---------------------|--------------|
| <i>Agapanthus</i> sp. | Purple, Pink, White | May - August | Partial Sun | |
| <i>Buxus sempervirens</i> | Inconspicuous | ---- | Full or partial sun | |
| <i>Carex comanu</i> | Inconspicuous | ---- | Partial sun | Ground cover |
| <i>Euonymus fortuneii</i> | ----- | ---- | Full sun | Ground cover |
| <i>Festuca glauca</i> | Inconspicuous | ---- | Full or partial sun | Self sowing |
| <i>Lavandula angustifolia</i> | Purple | May - September | Full sun | Shrub |
| <i>Liquidamber styraculifera</i> | Inconspicuous | ---- | Partial sun | Tree |
| <i>Ginkgo biloba</i> | Inconspicuous | ---- | Full or partial sun | Tree |
| <i>Nandina domestica</i> "gulf stream" | Inconspicuous | ---- | Partial sun, shade | Dwarf |
| <i>Nandina domestica</i> | Cream | July - August | Full sun | Shrub |
| <i>Phormium tenax</i> | ----- | ---- | Partial sun | |
| <i>Prunus ceracifera</i> "atropurpurea" | Light Pink | March | Full sun | Tree |
| <i>Prunus serrulata</i> "kanzan" | Pink | April | Full sun | Tree |
| <i>Rosmarinus officinale</i> | Purple | July - October | Full sun | Shrub |
| <i>Vinca major</i> | Pink | April - May | Shade | Ground cover |



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Conclusions

Green roofs are important habitats in urban areas. They can be part of a larger green network, hence contributing to the quality of life in dense urban environments. Proper plant selection plays a vital role in the design of green roofs. In this work, examples of extensive and intensive green roofs were shown in commercial and residential cases, respectively. And then, the list of plant materials mostly used in these cases were presented in a table format. In spite of the many constraining factors of plant selection for green roofs, the choices are not limited to plants in these lists. There are some nurseries that exclusively focuses on green roof plants, and their inventory is growing as horticulturist continue their research. Besides, mother nature is full with opportunities in this regard.

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GREEN SKYWAYS : THE CONTRIBUTION OF GREEN LOFTS IN SUS- TAINABLE MODERN CITIES

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Abstract

Green roofs have been introduced by planners and stakeholders as an alternative way of greening compacted urban centres. The paper deals with the methodology of selecting impervious spaces on roofs in order to introduce vegetation, connect them to the urban fabric and create a new story of green network, a green sky network.

Introduction

Extending green tendrils into the city centers, organizing metropolitan areas within and around a green framework, and constructing green spaces where nothing exists, are planning and designing proposals of since the beginning of the 20th century. Today, cities around the globe need such interventions as never before, given escalating urban populations and increasing rates of land consumption. However due to the changes in the physical landscape of cities, many changes in habitats for plant and animal species have been noticed. The new era needs new ideas and green places where some years ago ce-

ment and tiles roofs have been the most common solutions.

Compact urban areas are characterized by the close juxtaposition of buildings and roads with limited interstitial space to insert greenery; mixed land use; and a union of form and function (Jenks et al., 1996). The compact city here encompasses the high-density built form (Burton et al., 2002) with a high proportion of the land surface covered by buildings and other artificial structures and surfaces. The ratio of impervious to pervious areas is very high (Arnold and Gibbons, 1996), and conditions for plant and animal life are usually trying. The advantages and disadvantages of compactness have been well expounded. Many cities contain areas with exceptionally high development density in the inner city or the old urban core, formed by organic accretions. Some cities develop new compact areas or infill existing areas to a higher density (Williams, 1999). Whether old, modified or new, such compactness needs more attention to greenspace provision and environmental well-being, which could be overlooked or sacrificed (Jim, 1990). Green roofs have been one of the most promising solutions for greening the cities and creating new green areas in the compacted urban structures.

They can act as the connecting pieces in the green puzzle of urban structure since they provide space for urban green where impervious areas are traditionally established. By introducing urban plazas on top of skyscrapers or designing native habitats on inclined roofs, apart from increasing the green ratio in the cities, we create a new “storey” in the urban green network. The continuation of green areas not only in the top of the



“Creating Landscape on a Roof”

buildings but also in the facades provides a safe and easy corridor for the penetration of nature in the compacted city. The vision of Hunderwasser and the construction of green balconies and buildings, is not only feasible but essential to be accomplished for the upgrade of environmental quality, quality of life and human health. Many cities provide green spaces in new developments and preserve existing green in redevelopments and expansions in an attempt to echo the garden-city ideal. Green skyways, a connecting series of smaller or bigger green spaces on top or within building structures creates the appropriate conditions for a well established green network.

The installation of green roof on the buildings is technically and practically well established in USA, Japan and Europe and, particularly. Green roofs offer a sustainable green surface by improving urban climate, minimizing heat island effects and simultaneously protecting biodiversity. Plants have a strong effect on climate. Flora protects buildings from solar radiation in the urban environment by offering an aesthetically agreeable shading, controls temperature and humidity of the outdoor and indoor environment and supplies additional protection to building from winds. In closed spaces with planted roofs, the air temperature beneath the plants, during summer time, is lower than that of the air above. Plants also help mitigate the greenhouse effect, filter pollutants, mask noise, prevent erosion and calm their human observers. Shading from trees is an effective way to minimise the cooling load of a building. The difference between a conventional bare roof of a building and a planted roof can be considered qualitative and quantitative. The process of heat transfer into the planted roof is

totally different. Solar radiation, the external temperature and the relative humidity are reduced as they pass through flora that covers the roof. The plants with their biological functions, such as photosynthesis, respiration, transpiration and evaporation absorb a great proportion of solar radiation. Green roofs present an effective and positive impact on the urban climate and microclimate as well as on the indoor climate of buildings beneath them. Apart from solar protection and shading they contribute significantly to air purification and urban heat island effect reduction.

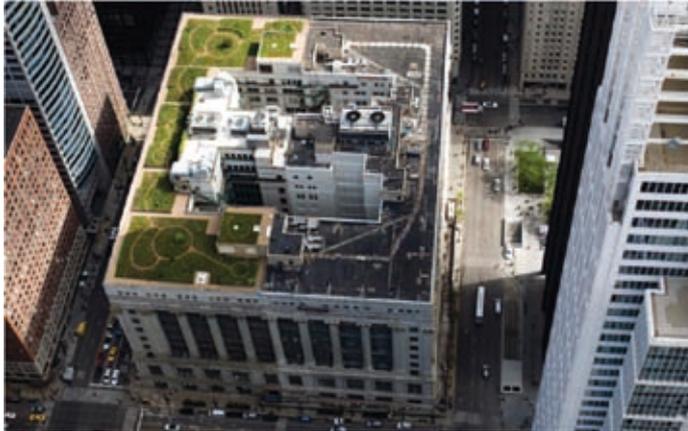
A green roof system can provide shading and protection from solar radiation during the cooling period of the year, minimize the building's energy consumption especially during summer period (Dunnett & Kingsbury, 2004).



Picture 1. An intensive roof garden in garden in Portland, The Louisa Apartment Complex



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Picture 2. Chicago City Hall



Picture 3. Museum in Mexico

Also, they filter polluted air in the urban environment, ameliorate the urban heat island effect, improve microclimate, create

wide space for recreation, etc.

The implementation and installation of green roof systems on buildings is widely known all over the world offering a sustainable green surface for improving micro-climate to public benefit while simultaneously contributing to biodiversity protection. Green roofs can be distinguished in two categories:

- (a) Intensive, which are characterized by a deep territorial stratum in order to face the large number and variety of plant species that results to disadvantage due to the requirement for methodic maintenance (picture 1).
- (b) Extensive, which are characterized by a lightweight of territorial stratum that requires small maintenance (picture 2, 3).

Green Networks on a skyline

However connecting greens spaces is a task performed not only on a ground level but on vertical and skyline level as well. In compacted urban agglomerations where the buildings and infrastructure network occupy the ground level, bringing together habitat (picture 3) and composing green fractions will be accomplished by finding and greening alternative urban patches as facades, rooftops, balconies etc.

Connecting urban green spaces both on ground level and on the skyline introduces an extended urban green network which will play an important role throughout the different sections of urban life and create new space for human living and nature (picture 4).



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Picture 4. Image of the city of Portland. Extending the green network to the industrial zone

Roofs are used as habitats and perform an interactive role in the society, providing a continuation in the environment link-ages wildlife corridors between derelict areas, rivers (picture 5), dums, corridors and urban places and connecting them to the urban spine.

The produced city is a city with high-quality and generous green spaces which will be an example of sustainable planning and management, a healthy environment for humans, vegetation and wildlife populations.



Picture 5. Connecting the river to the City of Houston



“Creating Landscape on a Roof”

Pilot case: the city of Larisa

A pilot project on the city of Larisa has given impressive results on the green ration before and after proposing the greening of public buildings (educational and institutional buildings). The maps show the extent and provision of green places in contrast to the urban fabric. The proposed areas will provide new habitats and play a significant role for the protection of biodiversity; they will improve standards of urban living, contributing to physical and mental health.

In order to select the proposed areas a new classification system of urban green places was introduced and a series of environmental parameters have been set up. In that way we evaluated the contribution of the proposed areas, as components of the green network. The methodological research has been a combination of analytical research and theoretical survey of international methodologies and study-cases that was built on earlier green infrastructure assessments. It incorporated landscape assessment and urban planning in order to identify fundamental greenway connectors and hubs (major and minor green areas). Parametric landscape methods and analysis through GIS was used in order to select and delineate the proposed networks (Lionatou, 2008). The methodology was composed by four separate stages:

- Identification and description of human and ecological assessment factors
- Classification of green areas and landscape assessment – suitability maps
- Assessment and identification of major destination green areas and greenway connectors through a combination

of attribute table calculations, statistics and database operations, polygon intersections, buffer and rank selection using ArcGIS software

- Delineation of major and minor green network as a result of suitability and impedance map calculation and analysis. The proposed methodology is conducted and tested in a study case in Larisa, a medium size city, where urban development, shrinkage of the green undeveloped areas and the continuous growth of the city core causes a transmutation in the urban network. The scope arises in multiple levels and engages protecting of ecological habitats and natural resources, establishment and planning of new green areas, linkage of natural, agricultural, recreational, historic and cultural areas via green infrastructure, grant of public access through greenway connectors and benefit from the scenic, recreational and imperative opportunities provided therein.

The proposed final green network is the result of bringing together islands of land and fractions of greenery, the outcome of introducing green and wildlife where cement and hardscape existed, creating a green umbrella, a sustainable living green sky-network, a ground network and a vertical mesh which will integrate urban nature and city's fabric.



“Creating Landscape on a Roof”

COMBINATION OF SUITABILITY AND CRITERIA MAPS



HYDROGRAPHIC NETWORK



MICROCLIMATE SUITABILITY MAP



ACCESSIBILITY MAP



INFRASTRUCTURE NETWORK



LAND USES SUITABILITY MAP

PROPOSED GREEN NETWORK

LEGEND

-  PROPOSED GREEN AREAS
-  EXISTING GREEN AREAS
-  PROPOSED GREEN CORRIDORS AND CONNECTING GREEN ROUTES
-  PROPOSED GREEN ROOFS & GARDENS IN PUBLIC BUILDINGS





Conclusions

Re-venting green spaces and bringing nature into the city has become a most complex issue since we need to examine not only the actual proposed green roof but the green network it is connected to. The proposed methodology for the selection and design of the green roof as a particle of the green sky network will enhance not only the compacted urban structure but also it will re-establish urban vegetation and enrich biodiversity.

Conclusion is summarised by the words of Friedensreich Hundertwasser, an artist, architect, ecologist and are considered as a vision of the 21st century:

Everything under the sky that is horizontal belongs to nature.

One must be persistent in the quest to green, or forest, all rooftops so that from a bird's – eye view, one would only recognize a natural, green landscape.

When one creates green roofs, one doesn't need to fear the so-called paving of the landscape: the houses themselves become part of the landscape.

People must use the roofs to return to nature what we unlawfully took from her by constructing our homes and buildings- the layer of earth for grasses and trees.

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THE IMPLEMENTATION OF GREENROOF TECHNOLOGY IN LANDSCAPED ROOFS. EXAMPLES FROM GREECE

Helli Pangalou ()*

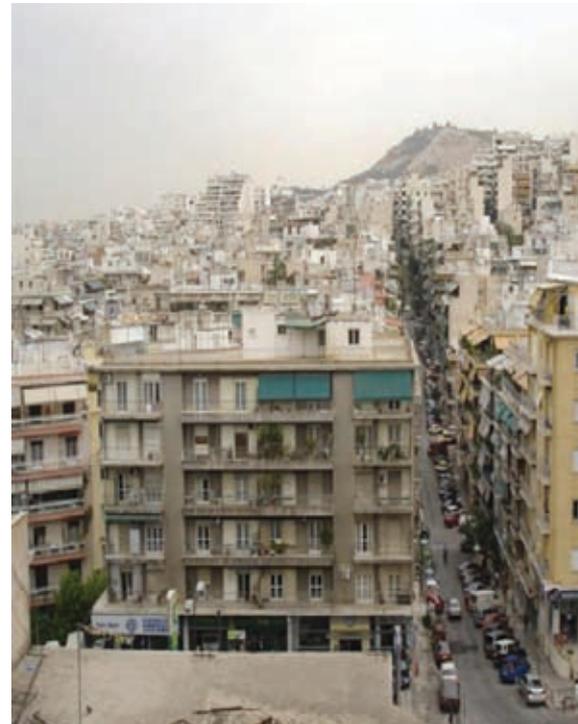
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Abstract

Greenroofs are becoming more widespread as a basic tool of bioclimatic architecture. The advantages of greenroofs are numerous, from environmental to economic and social benefits. Greenroof design and construction should follow set regulations and technical specifications. Local conditions, legal and planning actions should also be considered. Many countries have adopted greenroof policies to promote greenroofs as a means of green development. Greece, does not have a legal framework or policy on greenroof, nevertheless some actions were adopted by the local authorities on the grounds of water management and energy saving. Several examples of greenroof developments in Greece are illustrated.

Greenroofs and Bioclimatic architecture

Greenroofs are becoming more widespread as a basic tool of bioclimatic architecture, since greenroofs appeal to the essential needs of people, to the need for a healthier and friendlier environment. Greenroofs can contribute in today's environmental awareness and amend part of the destruction that was caused from urbanization.



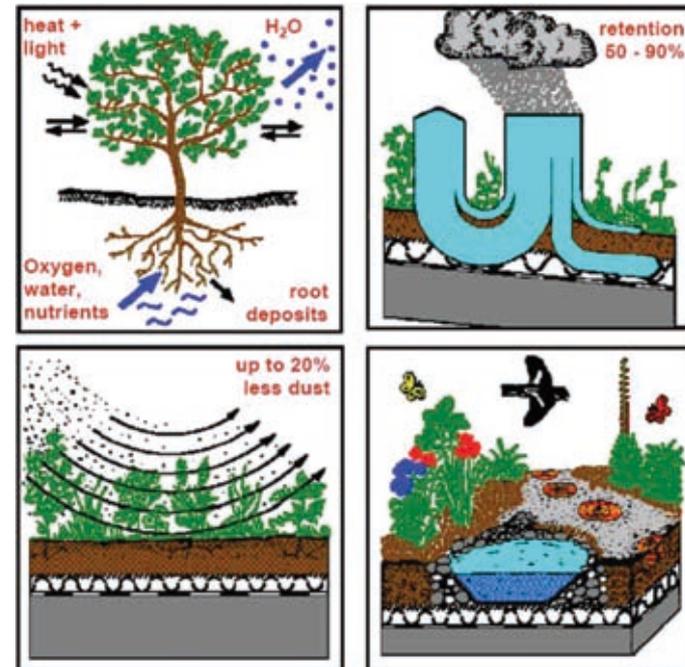
Picture 1. Degraded urban environment



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Greenroof Advantages

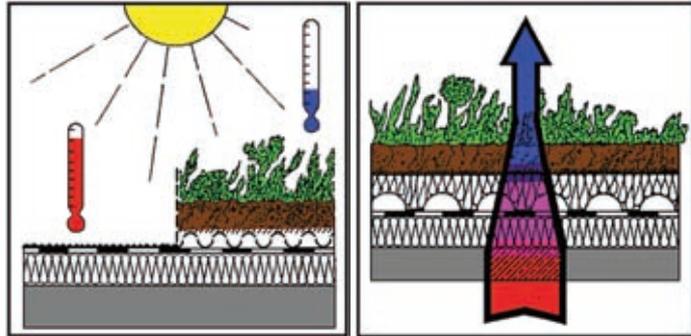
Greenroofs The advantages of greenroofs are numerous, from environmental to economic and social benefits. Greenroofs create natural habitats for animals and plants, as well as living spaces for people. Greenroofs minimize the “Heat Island” effect. Large scaled urban green roof development can reduce localized ambient temperature significantly. Greenroofs also reduce carbon emissions, since they reduce energy consumption of air conditioning systems, and contribute to pollution reduction. According to a theoretical and experimental analysis on the thermal behaviour of a greenroof system in two residential buildings, conducted by the Physics Department, Section of Applied Physics at the University of Athens, green roofs contribute highly to decrease the cooling demand of insulated buildings. A cooling load reduction close to 11% has been calculated for the considered residential building. Furthermore, a greenroof protects the waterproofing from UV exposure and temperature fluctuations, thus increases the life expectancy of the roof. The increasing use of greenroofs in cities significantly reduces the risk of flooding, as 50-90% of rainfall is retained in the substrate to evaporate slowly. The natural evaporation cools the air and reduces smog levels.



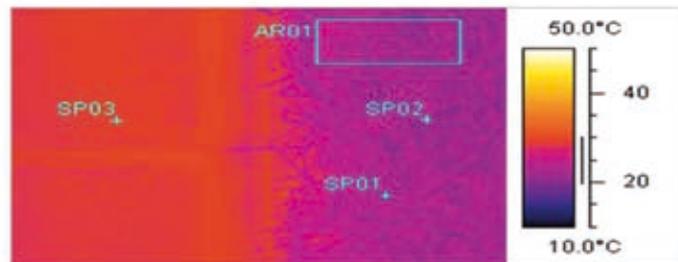
Picture 2. Greenroof benefits from the view of nature conservancy and urban ecology



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Picture 3. Greenroof thermal behaviour

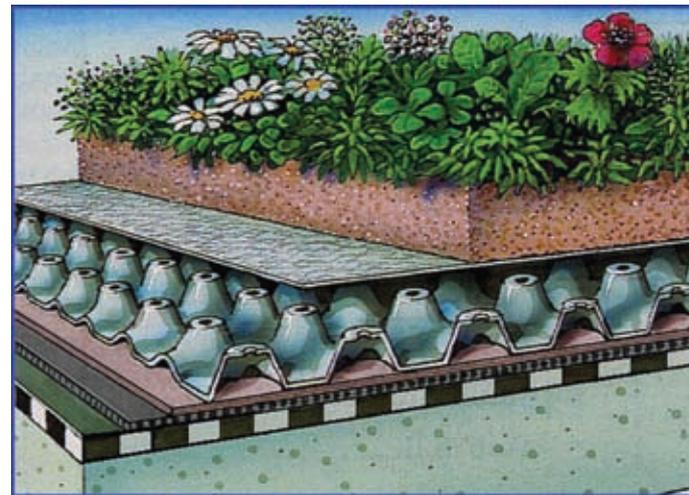


| | |
|------|---------|
| AR01 | 22.7 °C |
| SP01 | 21.9 °C |
| SP02 | 20.1 °C |
| SP03 | 29.4 °C |

Picture 4. Analysis on the thermal behaviour of a greenroof in a residential building in Athens. The surface temperature in hardscape in comparison with the planted surface of the greenroof

Greenroof Build up. The Layering

Specially designed greenroof systems are available for every application from flat roofs to inclined roofs. A greenroof build up should consist of a multilayered system that comprises, waterproofing, a root barrier, a moisture mat to retain moisture and nutrients, a drainage element that retains water in the profiled troughs, and at the same time provide the necessary aeration to the root system. On top of the drainage element, a filter membrane will prevent fine particles being washed away and finally the growing medium and the plants.



Picture 5. A multilayered greenroof build-up according to FLL guidelines



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Greenroof Types

There are three types of greenroofs, extensive, semi intensive and intensive.



Picture 6. Extensive Greenroof in Scotland

The extensive greenroofs require minimal maintenance; they are lightweight with a substrate of 50-150mm. Semi-intensive require a greater substrate build up from 100-250mm. They can support a wide range of plants and they require periodic irrigation and maintenance. Intensive greenroofs usually consists of both soft and hard landscape. The substrate ranges from 150-1500mm and they require regular irrigation and maintenance.

Greenroof Guidelines and International Policy

The incorporation of a greenroof into a new or a refurbished building should be based on many factors. Primarily, the use of



Picture 7. Intensive Greenroof in Athens

the greenroof should be defined, as well as the load bearing capacity of the roof structure. The location of the building and wind exposure play an important role, together with the selection of the special system build up and plants associations.

As greenroofs are prevailing, the need for International rules and guidelines for the design and construction of greenroofs is necessary.

In Germany, the leading country in the field, the FLL Guideline for the Planning, Execution and Upkeep of Green Roof Sites were published in 1990, and they are constantly revised –most recently in 2008- to keep up with technical progress. Most European countries as well as the USA, are following the German guidelines, however different regional conditions, i.e. climatic factors, building tradition, local flora, as well as legal and planning aspects should be taken into consideration.



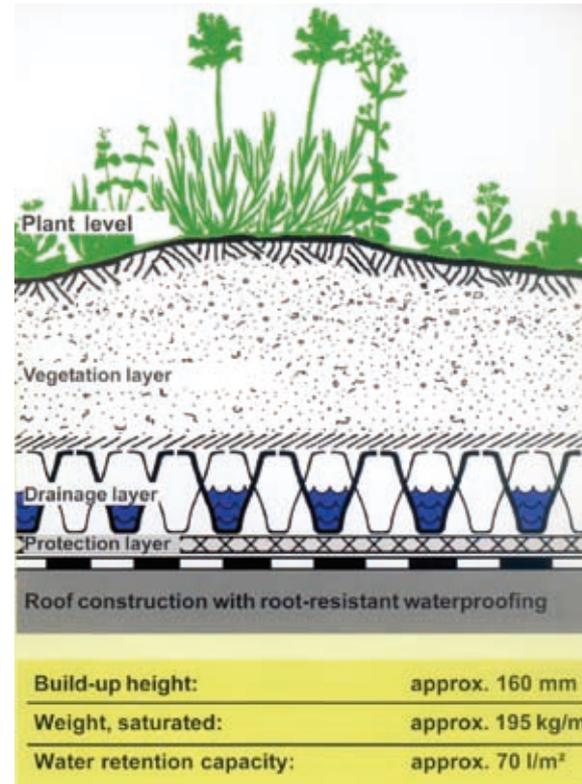
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Many countries in an effort to promote greenroofs have created the necessary legal framework to enable funding, through financial subsidies or planning regulations. In Germany, Berlin, Hamburg and Stuttgart are promoting the implementation of greenroofs. The city of Linz in Austria has developed greenroof policies since 1985, whereas in 2008 London has initiated greenroof policy for the Greater London Area. In Greece, there is no legal framework or policy on greenroofs, nevertheless some actions were implemented and designed through local authorities, based on energy saving program funded by the European Union.

Greenroofs' Implementation in Greece

Greenroofs should be adopted in Greece as a means for green policy. There is an increasing awareness, initiated both by individuals and environmental groups. Local authorities should promote greenroofs through a set of regulations in local development plan with the appropriate environmental guidelines, together with financial incentives in the form of subsidies or tax reduction. Most of the greenroofs that are designed and constructed in Greece are semi-intensive and intensive greenroofs, to meet the need for green open spaces.

The first greenroof in Greece according to international standards and FLL Guidelines was designed in 1999 in Athens. It was an intensive greenroof with ZinCo build up system, to achieve low static load and at the same time, maximum resource protection. A green open space of 200sm was created,



Picture 8. For Semi-Intensive Greenroof System build up

and proved to have a beneficial effect on the residents. Mediterranean plants were used such as myrtle, rosemary, lavender. A special type of lawn with low water demand was also used. The greenroof build up has a storage capacity of app 25 lt/sm. Plants are irrigated through drippers and sprinklers.



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Picture 9. The first Intensive Greenroof with a build up system according to FLL guidelines



Picture 11. Before and after the construction of the greenroof

The following greenroof system build up was specially designed to incorporate the installation of PV panels, whereas planting was based on “xeroscape” approach.



Picture 10. Step by step installation of an intensive greenroof in Attica



Picture 12. Semi-Intensive Greenroof in Athens with special base for PV panels



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There are several examples of greenroofs in Greece with detailed design and special features, shading structures, decking etc. Greek architects are incorporating greenroofs in the new building's design or in the refurbishment of old buildings, to provide living space for the residents. The next step is to set the Greek standards according to established guidelines, give initiatives to implement greenroofs on a larger scale in public buildings, in order to maximize environmental and energy saving benefits with up to date technological solutions.

Conclusions

Greenroofs can play a key role to sustainable urban planning. They can maximize environmental and energy saving benefits with up to date technological solutions. It is of utmost importance to set the regulations for greenroofs in Greece. The German FLL Guidelines could provide a well developed base for regulations standards, and can be adapted to local conditions. Local authorities together with the Ministry of Environment should develop a legal framework for greenroofs and give initiatives through funding programs, to enable greenroof implementation in larger scale, and account for green sustainable development.

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THE BUILDING AS “LANDSCAPE”

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Abstract

Without a doubt, we all perceive built environment as the set of the shelters we inhabit. The term green architecture inevitably refers to the relation between the buildings and the free space surrounding them.

Our familiar relation to the earth is obvious. The buildings are made of natural materials and stand on the ground. The set of buildings that stand on particular piece of earth become our settlements, our villages, our cities and the urban concentrations that we live in.

Contemporary architectural design displays a variety of examples of buildings in prolific dialogue with nature and artificial landscape. New urban context lays numerous issues on the relation between nature and city, built and open space. The examples used in this article can be divided in two major categories:

The building as “landscape”

The landscape as “shell”

1. Introducing landscape on a roof: Building+Earth

Green architecture, green cities and green roofs are terms that become more and more fashionable these days. We are using them to comment on the sustainability of the spaces we inhabit. Therefore, the relationship between built manmade space and natural environment is being reconsidered. Without a doubt, we all perceive built environment as the set of the shelters we inhabit. The term green architecture inevitably refers to the relation between the buildings and the free space surrounding them. Our familiar relation to the earth is obvious. The buildings are made of natural materials and stand on the ground. The set of buildings that stand on particular piece of earth become our settlements, our villages, our cities and the urban concentrations that we live in.

2. “Landscrapers. Building with the land”

*“Buildings replace the land. That is architecture’s original sin. What was once open land, filled with sunlight and air, with a distinct relationship to the horizon, becomes a building. The artifices of humans superscede what nature has deposited on a given place. The bulk of a building stops air, sunlight and views. The memories that we built up around that particular place, either individually or as a culture, also disappear. In their place there is a structure that is new, if only for a moment, and that aspires to have a perfect form, function and appearance. Some buildings even hope to move as far away as possible from the land on which they rise. In all cases, a building is one thing above all else: not the land.”**

*A. Betsky, “Landscrapers. Building with the land”, Thames & Hudson, London, 2005.



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3. The ‘familiar’ relationship between the land and the shell is being challenged.

Our ‘familiar’ relationship between earth and the building’s shell is being reconsidered by contemporary architectural design. The earth, usually conceived as the obvious ground of a building, can be transformed into the roof or side wall of it. The notion of the ground can also be inclined following the or even defining the outline of a building structure. Therefore, it no longer appears to be linear, static or horizontal. In some cases it becomes the epidermis of a shell obliterating its mass. At this point, we should be quoting the historic importance of underground buildings. Recurring throughout human civilization, undermined buildings become no man’s innovation today.

4. Is it the ‘building’ defining the land or land defining the building?

Contemporary architectural design dictates a more complex relation between land and the building shell, without relating to extreme contour topographies. In most cases, the earth is being redesigned to form a new ground for the shell or even part of its mass. The question naturally arising by the previous rationale comes as a natural outcome. Is it the shell claiming the land or is it the land claiming the shell? In other words: Is it the building defining its surroundings or is it the pre-existing land defining the outline and the form of the building? A piece of cultivated earth on a building’s top is different to a mass that becomes a building after complicated land elevations.

5. A new complex building on a new reconstructed ground

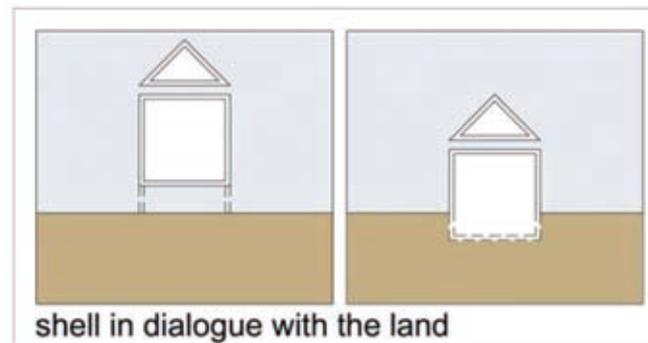
At this point two relative positions can be stated:

- The procedure of conception and implementation of a building gradually becomes a complex procedure with various stages. From the early stage of the initial “morphosis” to the final built form special tools are required.
- The open environment surrounding a building, no matter how “green” or “natural” it seems it is a reconstructed ground.

6. The building as ‘landscape’ & the landscape as “shell”

Contemporary architectural design displays a variety of examples of buildings in prolific dialogue with nature and artificial landscape. New urban context lays numerous issues on the relation between nature and city, built and open space. The following architectural examples can be divided in two major categories:

- The building as “landscape”
- The landscape as “shell”



Picture 1. Diagram visualizing the relation between the building shell and the ground



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Picture 2. Diagram visualizing the shell claiming the land



Picture 3. Diagram visualizing land claiming the shell

7. The building as “landscape”

We are going to quote a few international examples of contemporary architecture where parts of a building shell become the excuse for green terrain in the city.

7.1. “Bundeskunsthalle Bonn”, Germany, 1992

Gustav Peichl

The Bundeskunsthalle is a building with a roof that provides

public green space for a variety of events linked to the museum’s program. It is an elevated caricature garden with separate access from the ground floor. This landscaped roof is elegantly connected to the ground plaza that is designed to invite visitors to the entrance of the museum. The building’s volume orthogonal and austere becomes the base for the garden. The three towers lighting the interior become landmarks.

7.2. “Satelite tracking station”, Austria

Gustav Peichl

Due to the protected natural surroundings, the building of the station is built underground. A circular courtyard creates a controlled counterpoint to the undulating spaces around the complex. The main building of the complex revolves around this sunken courtyard remaining partly unseen. The green roof becomes an extension of the undisturbed surrounding nature.

7.3. “New building for the main library A.U.Th.”, A.U.Th. Campus, Thessaloniki, 1999

A. M. Kotsiopoulos, M. Papanikolaou, I. Sakellaridou

The building for the new wing of the main library of Aristotle University of Thessaloniki is an extension to the existing building designed in 1960. The new volume is designed as an underground building on the Northeast side of the pre-existing library. The scheme is deployed symmetrically around a cylindrical atrium. Its roof becomes a common ground for the surrounding buildings of the Campus. The green roof is enriched with new design features and a path to create a new “sunken



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courtyard” on the bottom of the atrium that gradually introduces visitors to the underground building volume. Natural light enters the building through the “sunken courtyard” representing a new cut on the ground plane.

7.4. “Hompukuji Water Temple”, Japan, 1991

Tadao Ando

In this example, a Buddhist temple disappears under an elliptical pool on Awai Island in Japan. The top of the building hosts a shallow water pond. The below-ground sanctuary takes the same shape as the lily pond above. Visitors descend into the building by a narrow set of stairs that slices through the surface of the water. The geometry of the building appears as a series of thin lines in the landscape hiding the volume of the building. The relationship between the building and its environment becomes a profound combination of architectural and landscape design. The building designed to house the temple is not an austere shell on a piece of land but evolves a different kind of interaction. The interior aesthetics reflect the respect to natural qualities.

7.5. “Naoshima contemporary art museum”, Japan, 2002

Tadao Ando

The main gallery of the art museum, in a small island of Japan, is skylight shell. The building is located on the top of a hill and placed completely underground. Its placement and its position refer to a kind of “earthwork” rather than a building. The museum appears in a sophisticated and precise interaction with

the landscape. It forms a refined man-made space.

7.4. “Central library”, Netherlands, 1997

Mecanoo

The central library of Delft Technical University appears in the form of a sloping grass plane. The roof of the building designates the shell’s relationship to the landscape. The whole mass of the building becomes an oblique green roof. A cone-shaped tower protrudes through this new ground to signal and anchor the place of knowledge in the city.

8. The landscape as “building”

The following examples show cases of contemporary buildings whose volumes are created through the folding of the earth. The building shell is almost impartible of its surroundings.

8.1. “City of culture”, Spain, designed 1999/ (construction in progress)

Peter Eisenman

Here we can see a model for a design proposal for a large complex of cultural facilities in Santiago de Compostella. The whole scheme is produced by overlaying a wrapped version of the streets with an orthogonal grid. The cuts in the model represent the streets and the solids the roofs. We can imagine that being implemented as a small pilgrimage town being covered with a green roof. Underneath the oblique roofs we can imagine a complicated structuring system. This design is revealing a complicated earth project. It shows the integration between



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earth and architecture and the man’s intention to order nature.

8.2. “Yokohama international port terminal”, Japan, 2004

FOA, Foreign Office Architects

The Yohohama International Port terminal is a new type of transportation space integrated with urban facilities. Rather than conceiving the building as an object on the pier ground, this prototype of terminal is hosting all necessary functions and creating a very large urban park on its roof. The building is designed as an extension of the urban ground, creating a unique relationship with its surroundings. Some critics note this project as nasty imitation of nature, pretending to be something it is not meant to be. Some others believe that is an excellent example of digitally designed landscape form. In any case it is an interesting example that nobody can overlook.

8.3. “Central square of Themi”, Themi, Thessaloniki, 2009

D. Kontaxakis, M. Kosmidou, S. Papadimitriou

This is probably the fresher example of all included in this presentation. It is the central square of an emerging urban district of Thessaloniki. The square forms the roof of a parking underground space in the center of the district. With complicated relationship to its surroundings the new scheme forms a complex and oblique urban playground, partly green and partly paved.

9. Conclusions

James Corner** proposes “Landscaping” as a solution to the disappearance of the city. The disappearance of the building into the landscape becomes a part of a larger typological evolution. It can be a way of creating green voids into our cities. Places of potential green action and open-ended strategic models.

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**James Corner, Professor of Landscape architecture, University of Pennsylvania.



“Creating Landscape on a Roof”

STUDIES OF PLANTING IDEAS OF RESIDENCES’ LOFTS – ROOFS AND APPLICATIONS

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Abstract

The Present Study was realized in September 2008, for the Pan-Hellenic Architectural Competition of the Greek Ministry of Environment (Υ.Π.Ε.ΧΩ.Δ.Ε.) in the frames “Environmental intervention” of Ministry of Environment. It was studied the installation of roof gardens in two buildings, one office building and one double housing, for the three climatic zones of Greece.

Introduction

The Aim of the Competition was to become studies of ideas on planting of lofts - roofs that can be applied in the three climatic zones (A,B and C) of Greece and that have been designed aiming at the improvement of energy output of buildings, the minimization of environmental consequences, via the regions microclimate improvement, assessing the impact of Roof garden on energy performance of buildings and any clear

pattern that would enhance the environmental value of green roofs in the built environment but also will identify the key problems that prevent so far their application in Greece.

Generally, the planted roof as part of the building envelope, affects the surface heat flow which has been fitted. The layers of planting and soil is a living system in the roof construction material, which interacts with a variety of ways with both the building and the external environment.

The criteria that shape the skeleton of the present Landscape Design Study are:

- Ecological
- Economical
- Qualitative
- Functional
- Phyto-social climatic
- Land and technical - architectural.

In the international literature, there are three categories of green roofs, which are separated depending on the thickness of layers and the requirements of the roof for maintenance. (extensional, semi-intensive, intensive). The Designers could select type of planting proportional to the way the building was going to be covered (loft or roof). Table 1 summarizes the technical characteristics of each type of construction.

Ecological Operations that Roof gardens offer to a Building are summarized below:



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- The exploitation of empty available spaces.
- The maximization of roofs' life duration and the offer of insulating protection in the roofs.
- The saving of energy by decreasing the needs for air conditioning and heating.
- The contribution in the reduction of dust and clouds by filtering the atmospheric pollutants with their vegetation.
- The contribution to a great degree in the reduction of noise pollution.
- The contribution in the increase of oxygen in the cities.
- The contribution considerably in the reduction of flow of rain waters in the drainage systems.
- The creation of ecosystems in the urban regions and the output of natural environment for plants and animals.
- And finally the improvement of microclimate and the airing in the cities

The methodology used to study plant Roof Garden in the present study is the following:

The office building was considered existing two-storey building in south free construction and urban design features similar to buildings constructed in the decades of 1980 and 1990 (buildings without insulation and bioclimatic design elements). In the building studied additional architectural placement assistance as architectural projections and vertical vegetation, to further improve its energy efficiency.

The building of double housing was considered a newly-built construction with south orientation, free construction in urban areas, consisting of two three story homes with integrated features of bioclimatic architecture. In the double housing also studied the installation of photovoltaic panels to convert the building at zero load power consumption.

The following restrictions were taken into account for the Designing

- Static Sufficiency: Calculation of additional charges in the static study of new buildings and control of static sufficiency for the existing buildings.
- Watertight of final structural surface and anti-root protection
- Multileveled stratification for reduction of energy losses with coating environment friendly materials and colors that absorb the solar radiation.
- Placement of light territorial mixtures for the smaller burden of static load.
- Draining - ensure of flow of water quantity being exceeded and flow rain
- Suitable irrigation system so that the real needs of plants are covered without water and energy overconsumption.
- In the proposals it was supposed to be selected non costly materials having as aim to be attractive for the users. In any case it was supposed to be submitted also the calculation of cost of proposed manufacture concerning the profit.



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The selected materials in every case were mainly environmental friendly.

Their main characteristics were:

- Light colors and Soft surfaces so that the temperature of the building would not increase because of solar radiation engagement as well as the materials naturalness so that they are connected to the plant cover of the space.
- To avoid burden the static load, they were used light constructions that they have aesthetic and mainly functional uses.
- The designing opinions for this spaces resulted based on the line, the texture, the form and the colour that was sought to have these spaces as well as the characteristics of buildings in which they are created.

According to the above mentioned the stages for the design were:

The climate analysis, the creation of favorable ground conditions for the vegetation and finally the choice of plant types and way of planting them, depending on the space and what will serve the particular planting.

Offices' building

The basic concept for the roof garden at offices' building is to transfer the facades of building on the roof with strict style lines. This is a 480m² surface and the entrance is in south-east side. The design was based on grid size 3 x 3m, which starting from the middle of the surface.

The most important thing in this case was the coverage of most of the surface with vegetation.

The type of planting was a combination of semi-intensive and intensive form. The variety of groundcover plants makes an open view site in all directions because of their low height, while it is not monotonous because of the “mosaic of vegetation - patches” that is formed. As a building, was provided a typical office building. The architectural intervention beyond the ornamental character, contributes to improving the energy behaviour of the building.

Ergonomic solutions were chosen to allow broad application. In this way it becomes possible the complete regenerate of the urban landscape, as it is an urgent need to adopt principles of sustainable development in the modern architectural design, both small and large scale.

A central corridor passes along the whole garden in irregular shape and for the access to the sitting areas there are secondary lawn corridors between vegetation.

The proposed uses are mainly walk and rest areas.

The proposed constructions are simple with natural materials and only the two planters combine two uses and also are a focal point. The planters were placed in central locations in space and closer to the sitting areas because they are lightings too.



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The central corridor of the area, is a brightly coloured wooden one, which is placed along the area, and determines the main route for users, giving them the chance to slip from the default path and reach the sitting area.

Double Housing

The Roof area of the Double Housing is an area of 23, 45 m² each.

The designing was based on the reference axis of symmetry which has been used for the design of the building.

The main point in the designing is the coverage of most of the building with vegetation such as the offices building.

The type of planting was a combination of semi intensive and intensive form.

There are five species of groundcover plants that shaping the “vegetation mosaic - patches” with their different textures and colours.

A small path made of light colour tiles (0,40 m x 0,40 m), arranged in steps between the lawn, passing the entrance to the planter. Because of the small size of the area, the proposed constructions combine multiple uses.

To assess the influence of the roof garden to heat and cooling loads and energy efficiency of Double Housing, was originally

considered that the building is newly-built with features of sustainable development and bioclimatic architecture. Also the designing aim was to take out as far as possible safe conclusions on the contribution of planted energy behaviour.

The installation of photovoltaic panels was studied for the Double Housing in order to cover needs for electric charge, turning it into a building with zero energy consumption.

Given the small size of the area, the proposed construction combines multiple uses. The planter which is the central point (focal point) also works as a lounge. Perimetrically of the Flow-erpot, wooden surfaces protruding (width 0,50 m and 2,00 m length) serving as the sitting area.

In the wall opposite the entrance is proposed to be placed small diameter planters (pots), which serve to illuminate the area. Finally, the proposed window boxes have no second use but their Π shape serves the rest configuration.

The plants’ selection is based on the climatic conditions of each climate zone in order to create a microclimate and to immediate adaptation, establishment and development of plants.

The proposed plants belong to the wider Greek and Mediterranean flora with the objective of biodiversity does not have large irrigation needs, can adapt and grow easily.

Other standards were: the aesthetic value, the height, the pos-



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sibility of pruning for the desired shapes ,the limiting of their development and the aromatic properties.

For the Present Study Collaborated team of engineers and researchers constituted from:

Agis Papadopoulos, Assistant Professor AUTH (Scientific person in charge)

Ifigenia Theodoridou, Architect Engineer (Coordinator of team of study)

Marinos Karteris, Mechanical Engineer

Dimitrios Anastaselos, Mechanical Engineer

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Dr. Julia Georgi, (PhD A.U.Th., MLA Univ.of Newcastle Upon Tyne), Landscape Architect, Advisor Prof. of Hellenic Open University, Ass. Prof. of Technological Educational Institute of Kavala

Anastasia Tsouflidou – Landscape Architect

Achilleas Kampouris, Graduate Student of Landscape Architecture

Dr Apostolos Karteris, Engineer of Environment

Dimitrios Pagidis, Agronomist M.Sc
kartECO - environmental and energy engineering consultancy

Christos Digkas, Civil Engineer M.Sc



Picture 1. The three Climatic Zones of Greece



Picture 2. Master plan of the Office's building



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Picture 3. Three-dimensional display of the proposed configuration for the Offices Building



Picture 4. Master plan of the Double Housing



Picture 5. Three-dimensional display of the proposed configuration for the Double Housing

Table 1. Technical characteristics of each type of construction

| TABLE 1 | | | |
|-------------------|-------------------------|---------------------------|---------------------------|
| TYPE | EXTENSIVE | SEMI-INTENSIVE | INTENSIVE |
| Maintenance | Minimum | Periodic | Frequent |
| Irrigation | Zero | Periodic | Frequent |
| Planting height | 60-200 mm | -250mm | >1000mm |
| Weight | 60-150kg/m ² | 120-200 kg/m ² | 180-500 kg/m ² |
| Installation cost | Low | Medium | High |
| Use | Ecological protection | Periodic accessibility | Full use |

Table 2. Plant selection for each climatic zone for the offices building

| TABLE 2 | | |
|--------------------------------|--------------------------------------|----------------------------|
| Climatic Zone A | Climatic Zone B | Climatic Zone C |
| <i>Ebenus cretica</i> | <i>Lavandula angustifolia</i> | <i>Berberis thunbergii</i> |
| <i>Cephalanthera cucullata</i> | <i>Pittosporum tobira</i> | <i>Origanum vulgare</i> |
| <i>Rosmarinus officinalis</i> | <i>Berberis thunbergii atropurea</i> | <i>Achillea “Taygetea”</i> |
| <i>Cistus creticus</i> | <i>Euonymus japonicus</i> | <i>Salvia triloba</i> |
| <i>Origanum vulgare</i> | <i>Salvia triloba</i> | <i>Thymus vulgaris</i> |

Table 3. Plant selection for each climatic zone for the Double Housing

| TABLE 3 | | |
|--------------------------|----------------------------|-------------------------------|
| Climatic Zone A | Climatic Zone B | Climatic Zone C |
| <i>Citrus aurantium</i> | <i>Olea eurapaea</i> | <i>Olea eurapaea</i> |
| <i>Coronilla cretica</i> | <i>Salvia triloba</i> | <i>Pittosporum tobira</i> |
| <i>Cistus creticus</i> | <i>Berberis thunbergii</i> | <i>Myrtus communis</i> |
| <i>Origanum vulgare</i> | <i>Cistus creticus</i> | <i>Origanum majorana</i> |
| <i>Ebenus cretica</i> | <i>Origanum vulgare</i> | <i>Lavandula angustifolia</i> |



“Creating Landscape on a Roof”

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<http://www.antemisarigr.gr>



OIKOSTEGES® THE SUPER LIGHTWEIGHT, SELF SUSTAINING NATURAL GREEK ECOSYS- TEM ON A ROOF

Andrew Michael Clements ()*

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Tel/Fax 0030 210 7250863 Mobile 0030 6947225590 <http://www.oikosteges.gr> email : info@oikosteges.gr*

Abstract

A self sustaining roof greening system for hot earthquake zones developed to supply a viable solution to the growing number of problems faced in the urban built environment.

Introduction

When the research began in 2002 for this system the Oikosteges team identified a number of issues related to roof greening in hot earthquake zones. The first issue that was identified was the weight of available systems, secondly the climatic peculiarities of earthquake zones was noted and finally the need for maintenance of existing roof greening systems available from Northern European suppliers. Oikosteges resolved to address these issues and the super lightweight self sustaining natural ecosystem was the result.

The Oikosteges System weighs in at below 50kg/M² wet, making it one of, if not the lightest roof greening solutions avail-

able. It can withstand the harsh conditions faced on the roof of a hot country like Greece with minimal or no irrigation and no requirement for maintenance and inputs. For all the above reasons the system was installed at the Greek Treasury, situated opposite the Greek Parliament – The first and only Treasury on Earth to sport a green roof. The system has been welcomed by landscape architects, civil engineers, architects and agronomists as the self sustaining solution to the issues that have hitherto prevented large scale implementation of roof greening in hot earthquake zones like Greece.



The Treasury – Constitution Square – Athens, Greece



“Creating Landscape on a Roof”

Roof greening is as old as the hills, literally. Human civilisation has passed through three distinct stages of development¹. The first distinct stage of development and differentiation from other animals was the rise of the so called agricultural civilisation c.8000 bc, which saw groups of humans, usually extended families, settling in a single location and developing the first communities which are still recognizable today as villages. Humans built dwellings in these communities.

The first building materials that man used were the things in his direct environment like earth (particularly clay), live plants, and dead plant material. At this time it was common practice to use either living plants or dead (in the form of straw for example) as the material of choice for the roof of shelters. Even these early farmers found that plants whether living or dead provided many benefits to the dwelling such as waterproofing, thermal insulation, reduction of storm water runoff, camouflage, beautification etc.

As agricultural civilisation flourished communities grew in size until they reached the size of modern small towns having many thousands of inhabitants. Roof greening continued to be popular in these communities and reached its highest form of expression, possibly, in one of the seven wonders of the ancient world, the hanging gardens of Babylon. Roof greening continued to be popular around the world throughout the middle ages. Celtic sod and thatched roofs found in the Scottish Highlands, Wales and Ireland are good examples of roof greening before, during and right up to the renaissance and beyond.

Examples of renaissance thatch can still be seen to this day in many countries including England. Possibly one of the most famous buildings with thatch are the Elizabethan buildings in Shakespearean Stratford-upon –Avon. Both Anne Hathaway’s cottage and Shakespeare’s house, which can be visited, are fine examples of the use of plant material for roofing.

The industrial revolution was the second distinct wave of human development and brought with it fundamental changes in human life as it swept across the planet¹ One of the most obvious changes the industrial revolution brought with it was the rise of the large town and modern city to serve the interests of the burgeoning new way of life, namely the formation of production facilities (factories) and markets for the sale of the products of industry. Factories and markets required workers and consumers who agglomerated in the urban centres we recognize as modern cities. Mass production and mass consumption brought with it the potential and necessity for large-scale urban development. Consequently natural building methods were replaced by industrial building methods and materials. Material processing became possible and desirable so natural building materials were abandoned and replaced by brick, ceramic tile, Portland cement and steel. The result can be seen from New York to Calcutta, from Reykjavik to Johannesburg.

The rise of the modern urban centre has brought with it a plethora of serious issues. Modern building materials and methods in conjunction with human industrial and consumption activity while serving human industrial and consumer needs in many



“Creating Landscape on a Roof”

respects are in conflict with the biosphere in many others. Consequently, humanity in the 21st Century finds its industrial activities, materialistic consumerism and its building materials and methods have led to severe degradation of the biosphere and many of the life support mechanisms of which we all depend are threatened. The challenges cities face include the urban heat island effect, stormwater runoff, epidemic levels of serious physical, emotional and mental illness, loss of habitat for the natural world, loss of biodiversity etc All these issues are discussed at length elsewhere so require no discussion here.

The aforementioned challenges began to become painfully evident to Western urban planners in the 1960's and one of the responses to them was renewed interest in natural building methods and materials. This renewed interest was particularly seen in countries like Germany and Switzerland. Interest in roof greening grew out of this and took root as a respected building method in both of these countries.

Initial attempts at roof greening in Germany failed for a number of reasons. One of the most serious issues when roof greening began in that country was waterproofing. This caused roof greening to be seen as problematic for over a decade. German urban planners responded to this in 1975 with the establishment of the German landscape Research, Development and Construction Society FLL The FLL is an independent non-profit organization. It was founded by eight professional organizations for “the improvement of environmental conditions through the advancement and dissemination of plant research and its

planned applications”(3). The FLL green roof working group is only one of 40 committees which have published a long list of guidelines and labor instructions. The FLL has been working on standards for green roof technology for 25 years. Their ‘Guideline for the Planning, Execution and Upkeep of Green-Roof Sites’ (FLL-guidelines) reflects the latest developments in German acknowledged state-of-the-art technology. Although the guidelines don't give solutions for all green roof problems it is a basic tool for the construction of reliable and high quality green roofs (2) As a direct result of the formation of the FLL roof greening has become extremely popular in Germany. Currently it is estimated that 10% of German roofs are now green (4) In Germany green roofing is primarily used as a method for the amelioration of storm-water runoff and carrot and stick legislation of grants and penalties has been instituted to encourage large scale roof greening.

Many attempts have been made for decades to introduce roof greening in Greece with little or no success. In fact there have been some spectacular failures, which has resulted in limited penetration into the Greek market. A number of large Northern European green roof suppliers continue to attempt to break into the Greek market and there has been some response during the last twelve months from the Greek state and from large companies and private individuals. What still dogs these attempts are the challenges mentioned earlier. Oikosteges have addressed and solved these problems after years of academic and real market research and have developed a system which is applicable to Greece.



“Creating Landscape on a Roof”

Conclusions

Large-scale implementation of roof greening is now feasible and viable in Greece using the Oikosteges System. For this reason the Greek Treasury decided to install the system in their building in Syntagma and the system has become popular with landscape architects, architects and civil engineers all over Greece, on the mainland and on the islands.

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http://en.wikipedia.org/wiki/Green_roof



The Meadow of Athens – Constitution Square



Part 2

Students Projects through the Landscape Workshop

- | | | |
|---|--|--|
| 1: Eleftherios PARTSALIS Kontsantinos ASLANIDIS Vasileios STAVRIDIS | 5: Marilyn DONTA Tania DONTSIU Manuela MATEI | 8: Vagia KOURLOU Panagiota MPAKRI Eirini XENIOU Katerina FRAGEDAKI |
| 2: Stella PITATZI Maria TZAHALAKI Eleni BARAMATI Yalin OCAL | 6: Eudoxia GOTSI Drosia ZAROGIANNI Fotini NANOU Pamir BIRLIK | 9: Marcelle LOIZOU Anastasia CHARALAMPUS Ioanna RIZEA Dinemis KUSULOGLOU |
| 3: Christina DAOUDAKI Maria KYPARISSA | 7: Katerina KOTE Sofia KONSTANTINIDI Mustafa UMURAN Orthodoxia MICHAEL Gizem KOLAT | 10: Lito MICHAILIDOU Maria BOUCHLI Athanasia NIKOLAIDOU Oprita Iulian ALEXANDRU |
| 4: Dilber KARA Thomi KATSIKA Sofia KIRGERIDOU Irina TZOURA | | |





“Creating Landscape on a Roof”

panoramic views

WORKING GROUP:
PARTSALIS ELEFTHERIOS
ASLANIDIS KONSTANTINOS
STAVRIDIS VASILEIOS

Υφιστάμενη κατάσταση (existing situation)

Φύτευση

- 1. Καλαμίσκοι
- 2. Φυτάκια
- 3. Γραμμοί ποταμιών
- 4. Καλαμίσκοι
- 5. Καλαμίσκοι

ΥΔΡΑ (materials)

- Τσιμεντο (concrete)
- Τροφίδια - πλακάκια (clay brick)
- Πηγή (water)
- Γλάστρες (glass)

Είσοδος - έξοδος (entrance-exit)

analysis

- the building
- the courtyard
- the terrace
- the lawn
- the building and roof
- roads

Working team:
Panagiotis Papanicolaou
Konstantinos Papanicolaou
Konstantinos Papanicolaou
Konstantinos Papanicolaou
Konstantinos Papanicolaou



“Creating Landscape on a Roof”

WORKING GROUP:
PITATZI STELLA
TZAHALAKI MARIA
BARAMATI ELENH
YALIN OCAL

ΥΛΙΚΑ ΧΡΟΨΟΥ- ΚΥΛΛΗΛΙΑΝ ΜΑΤΕΡΙΑΛΛΕΡ

| | |
|------------------------|----------------|
| ΒΑΝΙΚΟΠΡΟΨΗ-ΤΑΣ ΔΟΞΕΝΗ | ΜΑΡΜΑΡΟ ΜΕΡΜΕΡ |
| ΠΛΑΚΑΚΙ | ΤΣΙΜΕΝΤΟ |

ΒΛΑΣΤΗΣΗ ΠΕΡΙΟΧΗΣ

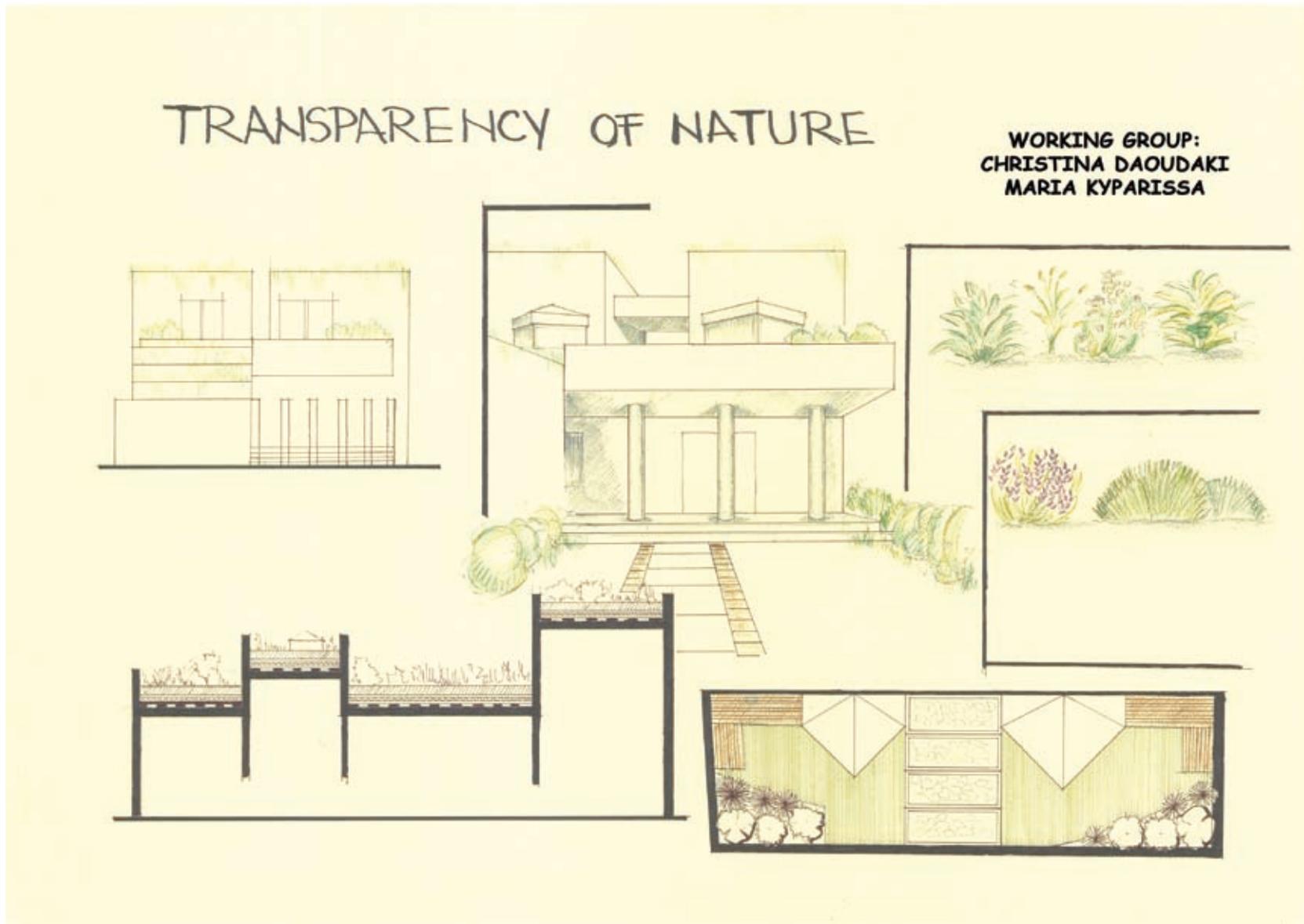
PLATANUS ORIENTALIS
POPULUS TREMULA
SALIX BABINGTONICA
PICUS CARRIONA
CRATAEGUS MONOGYNIA

We connect this area with the park with natural elements like water and trees

The form of construction building also should be compared to the proper because of its historical form.



“Creating Landscape on a Roof”

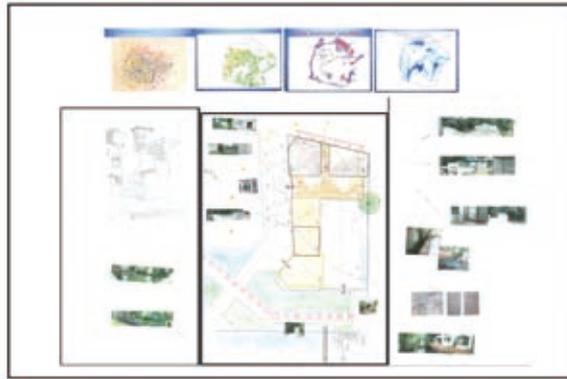




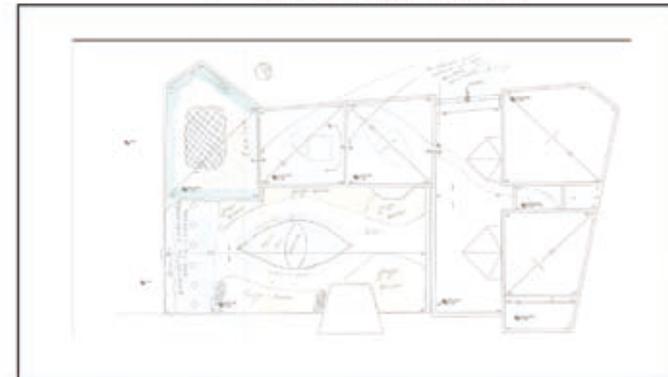
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" WORKSHOP 2009 - ΝΟΥΣ ΟΡΑ "

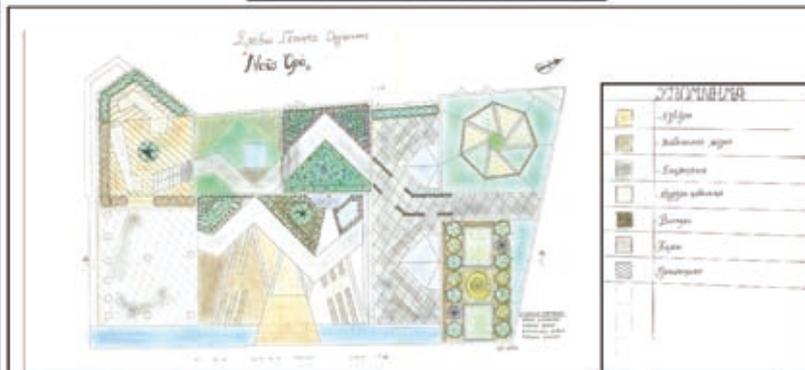
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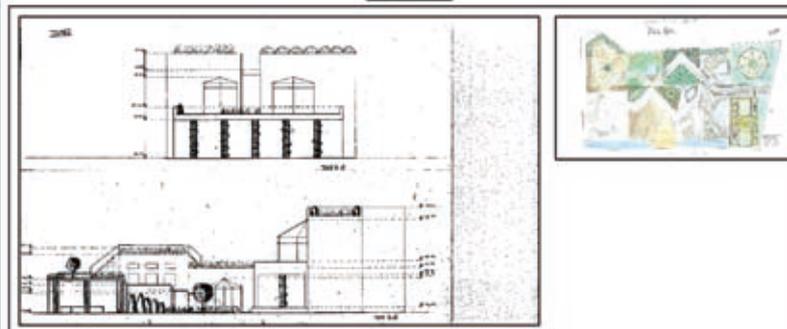
ΙΔΕΟΓΡΑΜΜΑ ΠΡΟΤΑΣΗΣ



ΣΧΕΔΙΟ ΓΕΝΙΚΗΣ ΟΡΓΑΝΩΣΗΣ



ΤΟΜΕΣ



WORKING GROUP:
KARA DILBER
KATSIKA THOMI
KIRGERIDOU SOFIA
TZOURA IRINI



Η βασική ιδέα για τον Ταρτσόκηπο του κτηρίου του Φεστιβάλ Ταινιών Μικρού Μήκους της Δράμας, έχει το όνομα "Νους Ορα" και συμμετείχε στο 4ο Workshop (2008). Η βασική ιδέα στηρίχθηκε και ξεκίνησε από το "Μέλι - Βλέμα" και εξελίχθηκε, σχεδιάστηκε και κατέληξε, στην σχεδίαση με κύρια όργανα και εξαρτήματα του κινηματογράφου. Όπως είναι το Κλίτρο του Φακού, το Φίλμ των Ταινιών και το Stop, Play και Pause κατά το παιχνίδι των ταινιών - φιλμ, όπου κυριαρχούν στον χώρο σχεδίασης και ο παρατηρητής - επισκέπτης, αφήνει την φαντασία του να τα ανακαλύψει... μέσα στο χώρο.!

TECHNOLOGICAL INSTITUTE OF KAVALA
DEPARTMENT OF LANDSCAPE ARCHITECTURE -
DRAMA

4th WORKSHOP
Drama, 11 - 13 May 2009

Creating Landscape on a Roof

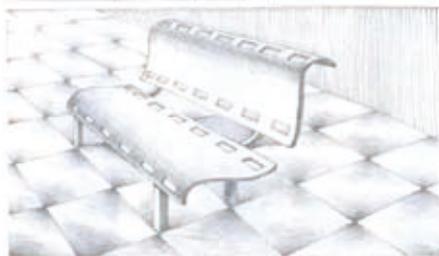
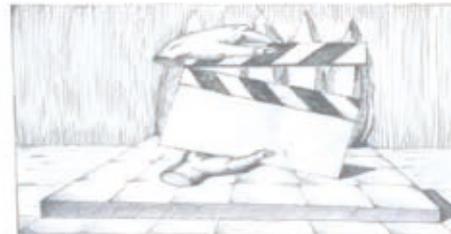
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Arch. Vasil Kyriakou
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“Creating Landscape on a Roof”



WORKING GROUP:
MARILYN DONTA
TANIA DONTSIU
MANUELA MATEI

“Creating Landscape on a Roof”



ANALYSIS

ORIENTATION OF REGION
 MICROCLIMATE-CIRCULATION-TOPOGRAPHY
 VEGETATION-STRONG WEAK POINTS

VIEWS
 MATERIALS OF COATING

TECHNOLOGICAL INSTITUTE OF
 KAVALA
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 ARCHITECTURE - DRAMA

4th WORKSHOP
 Drama, 11 - 13 May 2009

**Creating Landscape
 on a Roof**

Lesson: LANDSCAPE ANALYSIS
 AND DESIGN

Student group
 Gotsi Eudoxia
 Zarogianni
 Drosia
 Nanou Fotini
 Pamiir Birlik

Professor
 Dr. Julia Georgi
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 Arch. Vantza
 Kyriakou
 Arch. Eleni
 Antonara

SKETCHES

TECHNOLOGICAL INSTITUTE OF
 KAVALA
 DEPARTMENT OF LANDSCAPE
 ARCHITECTURE - DRAMA

4th WORKSHOP
 Drama, 11 - 13 May 2009

**Creating Landscape
 on a Roof**

Lesson: LANDSCAPE
 ANALYSIS AND DESIGN

Student group
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SECTIONS

SECTION AA'
 SECTION BB'

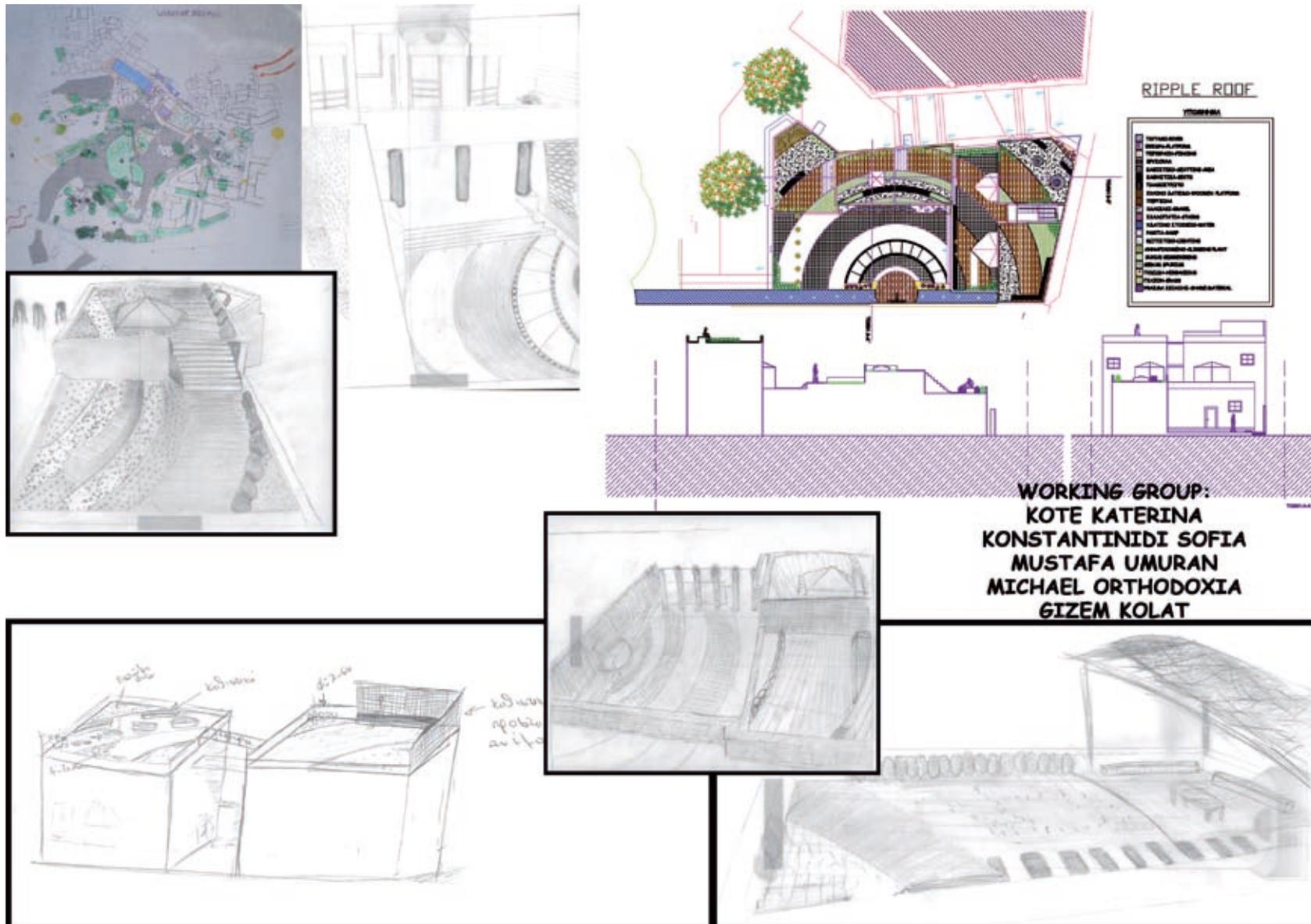
GROUND PLAND

A
 B
 A'
 B'

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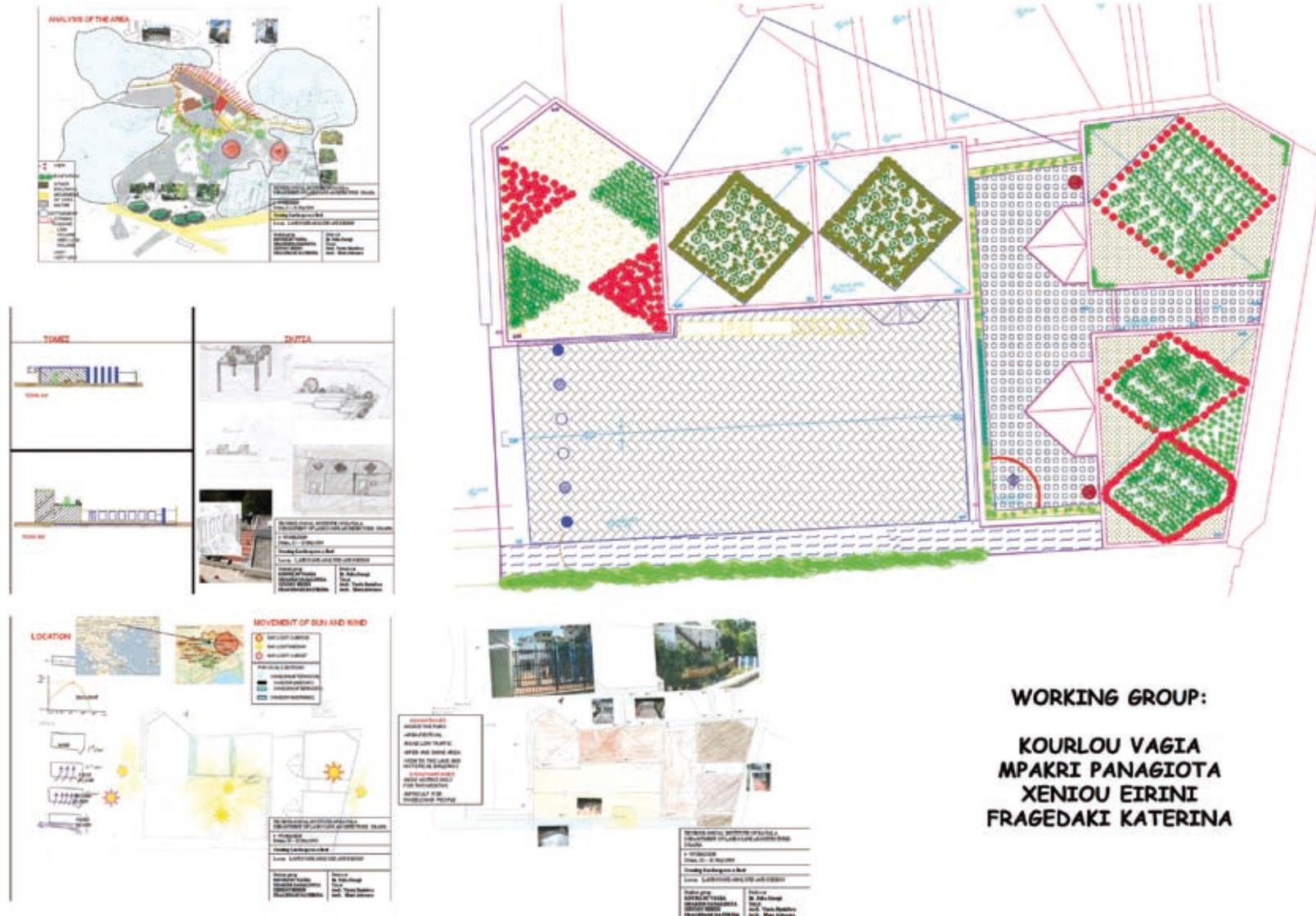


“Creating Landscape on a Roof”





“Creating Landscape on a Roof”





“Creating Landscape on a Roof”

LOCATION

ANALYSIS

TREES

MATERIALS

**CHARALAMPOUS ANASTASIA
LOIZOU MARCELLE
RIZEA IOANNA
KUSULOGLOU DINEMIS**

LEGEND

| Materials | Constructions |
|-------------|---------------|
| Wooden deck | Spotlight |
| Tile | Bench |
| Brick | Planter |
| Aggregate | |

| Plants | |
|-----------------------------------|---------------------|
| Eurythmum japonicum | Buxus sempervirens |
| Cupressus macrocarpa "gold crest" | Berberis thunbergii |
| Quercus ilex | Larix laricina |
| Juniperus sp. | Green |
| Passiflora foetida | |

**WORKING GROUP:
LOIZOU MARCELLE
CHARALAMPOUS ANASTASIA
RIZEA IOANNA
KUSULOGLOU DINEMIS**

LIFE AS A FILM



Names of the students who participated with their projects at the International Landscape Workshop 2009

Students from Technological Educational Institute of Kavala, Department of Landscape Architecture

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3. Tsanopoulou Maria
4. Tsarouhi Evagelia
5. Kara Dilber
6. Katsika Thomai
7. Kirgeridou Sofia
8. Tzoura Irini
9. Baramati Eleni
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11. Tzahalaki Maria
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13. Donsiou Tania
14. Reisi Elena
15. Psoma Despina
16. Aslanidis Konstantinos
17. Partsalis Lefteris
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20. Rizea Ioana
21. Kourlou Vaia
22. Bakri Panagiota
23. Xeniou Irini
24. Fragedaki Katerina
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29. Stavridis Vasilis
30. Daudaki Hristina
31. Kyparissa Maria
32. Matei Manuela
33. Gotsi Evdoxia
34. Zarogianni Drosia
35. Nanou Fotini
36. Spiroglou Elissavet
37. Kote Katerina
38. Sakellariou Antigoni
39. Konstadinidi Sofia
40. Mustafa Umuran
41. Mihail Ortodoxia
42. Santi Spiridoula
43. Mihailidou Lito
44. Bouhli Maria
45. Nikolaidou Athanasia
46. Oprita Alexandru
47. Vergini Kiriaki
48. Delioglani Vasiliki
49. Dampakis Panagiotis
50. Ravnali Pashcalina



“Creating Landscape on a Roof”

Students from Istanbul Technical University, College of Architecture, Landscape Architecture Department

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2. Gizem Kolat
3. Enverina Qoaraj
4. Yalın Öcal
5. Pamir Birlik
6. Dinemis Kuşuluoğlu
7. Selen Aksoy
8. Cansu Almali
9. Begüm Özerk
10. Seda Sultansu
11. İrem Tuğçe Kotiloğlu
12. Rengin Haksal
13. İzgi Uygur



