GREEN INFRASTRUCTURE GUIDEBOOKS

SUMMARY 2020

BUDAPEST


WHICH TOPICS ARE COVERED IN THE GREEN INFRASTRUCTURE GUIDEBOOKS?
1 PERMEABLE PAVEMENTS
2 GREEN FACADES
4 RELATIONSHIP BETWEEN URBAN TREES AND UTILITIES
5 RENEWAL OF DOWNTOWN INNER COURTYARDS
3 WATER SENSITIVE DESIGN IN URBAN OPEN SPACES
This publication aims to present five guidebooks in a nutshell that have been published in the care of the Municipality of Budapest. The publications issued so far process topics on which there is little or no Hungarian literature. The Municipality of Budapest wants to promote the developement of green infrastructure, the work of professionals and decision-makers and informing citizens via these guidebooks.

Renewal of downtown inner courtyards

GREEN INFRASTRUCTURE GUIDEBOOKS 5

The often neglected, underused or unused inner courtyards of condominiums in the historic urban fabric provide a unique opportunity to create new green spaces, outdoor recreational green places and to strengthen community life.

CONTENT

analysis of the situation in Budapest

While the capital city has an average of 6 m^2 of public space per capita, this rate in downtown areas is only 0-5 m^2/person. There are 120 ha of closed, tipically paved and underused courtyards in the inner districts. Most of these are potential green spaces.

developmental tools

Several tools are available to improve the usability and quality of inner courtyards from simple, cheaper solutions to complex, more expensive developments. The design is jointly defined by the characteristics of the courtyard, the needs and opportunities of the communitiy and the spatial planning aspects.

examples, best practice

Several good examples for patio develpoment can be found in the historic urban fabric of Budapest, behind the historical facades of houses built mainly during the last turn of the century. The guidebook presents many of these to motivate and inspire residents, investors and the local municipalities.

RENEWAL TOOLS
solutions for inner courtyards

There are many ways to make inner courtyards more livable. Some really depend on good intentions, others are costly, require lengthy preparation and professional involvem. Significant quality change can be achieved by the joint renovation of the doorway, the inner facades, the open circular gallery and the courtyard. Multi-level planted raised beds, bicycle racks, relaxation area with seating and tables, even water elements can be placed in courtyards with sufficient size and sun exposure. If the space is too tight or in order to increase the amount of green, various balcony gardens, vertical gardens can also be created. These and other similar solutions are presented in the guidebook Renewal of downtown inner courtyards.

STEPS OF RENEWAL

1. analysis
investigation of the history, technical and environmental parameters of the house and patio and identifying the community intentions

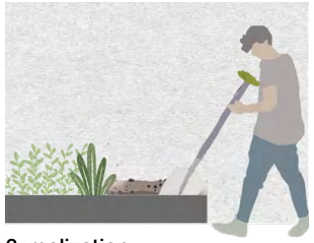
2. planning
communitiy planning: defining the old-new patio functions, financing and tendering opportunities, subsidies

3. realization
renovation of inner facades, open circular gallery, firewalls, doorways, pavement, necessary demolitions in the courtyard, hiding disturbing utilities, plant establishment, placement of garden furniture

4. maintenance
community maintenance, professional tasks

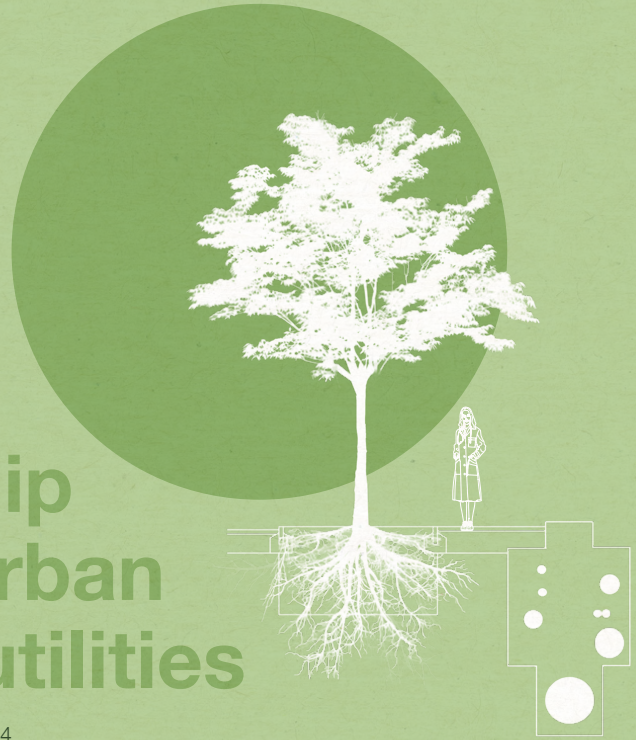
1. analysis

2. planning



3. realization

4. maintenance



Relationship between urban trees and utilities

GREEN INFRASTRUCTURE GUIDEBOOKS 4

When transforming urban public spaces, there is a strong social need for extending green spaces, planting of trees, tree alleys, humanization of our plazas and improving the proportion of green space. The more urbanized an area is, the greater the need for change is and higher the proportion of utilities underground. All this leads to a constant conflict between the utility works and the tree alleys and green spaces.

CONTENT

analysis of the situation in Budapest

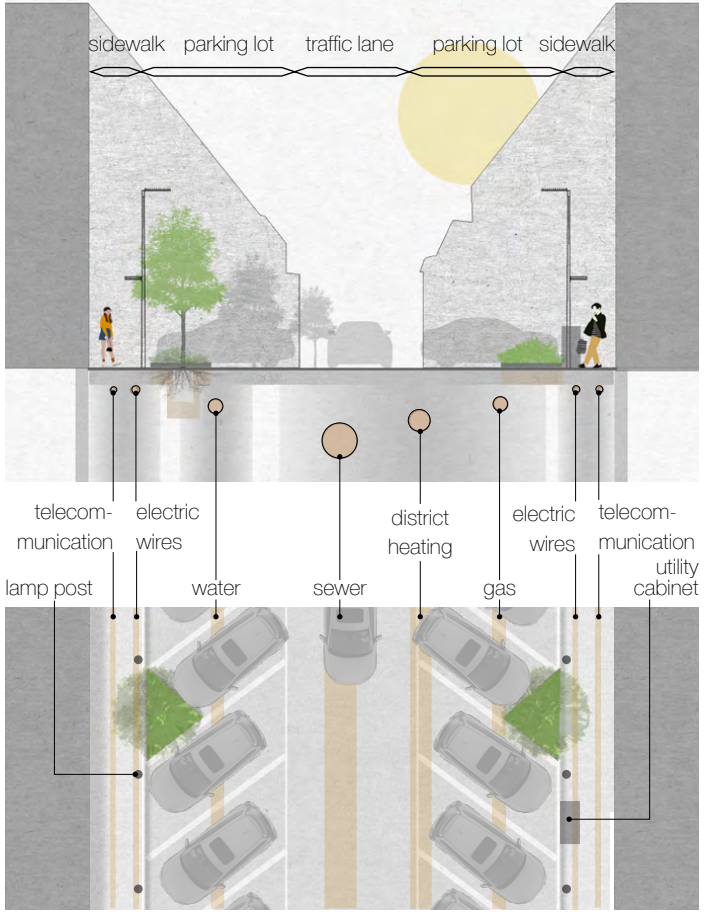
In the denser districts of Budapest a main obstacles for establishment of green spaces, and especially the tree planting, is the location of public utilities and their required clearance zones.

legal background

Legislative provisions and standardization conditions for public utilities affecting urban tree planting are incomplete or absent. Furthermore there is no unified and properly regulated wood protection and felling, which creates additional difficulties during design and implementation.

technical and innovative solutions

There are many ways to improve the afforestation of the city. While some depend only on a mutual compromise between stakeholders, other situations may require the use of innovative solutions.

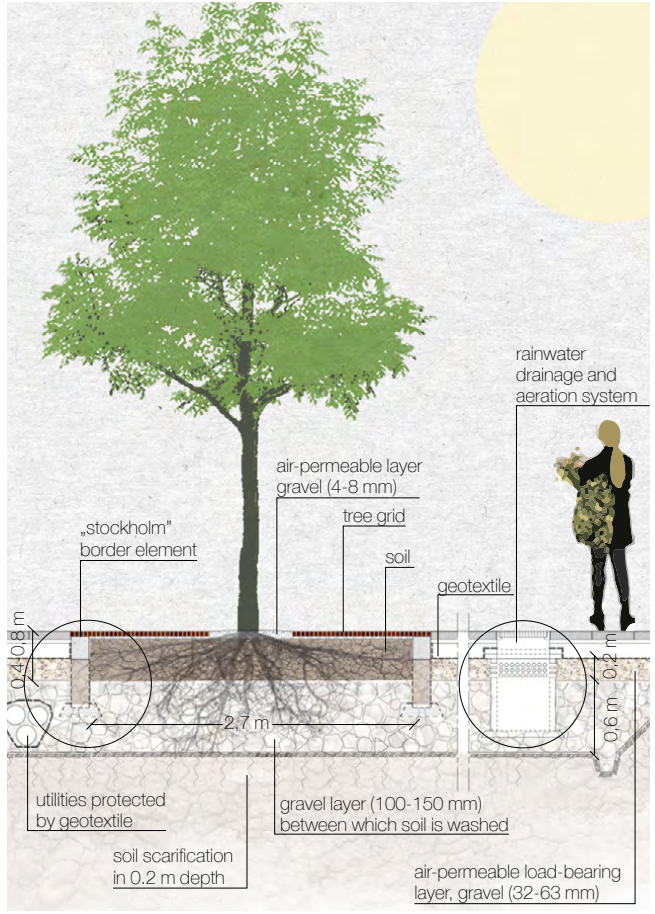


CONFLICTS OF TREES AND UTILITIES

Although invisibly, utility infrastructure occupies more and more space in the cities. Conflict between suppliers and trees begins already at planting stage due to lack of space. During the planting clearance zone of utilities must be taken into account, to ensure access in case of failure and repair. Unfortunately the roots do not stop at the limit of the clearance zone, they can weave the utility in, can cause damage to it or make it difficult to maintain. However, utilities can also cause damage to trees. During their construction and maintenance, the root system of the trees can be damaged, causing physiological and static impairment, which can make the tree unstable and therefore dangerous. Trees, green spaces and utilities are equally needed in cities. That is why solutions must be devised in which they all have their place on the streets. Such situations, solutions and suggestions are presented in the guidebook The Relationship between Urban Trees and Utilities.

INNOVATIVE SOLUTIONS
stockholm tree pit model

The publication provides several innovative solutions for the development of urban tree planting. An example of such solutions is the Stockholm tree pit model. The cities are characterized by disturbed ground filled in with construction waste. Increased transport demand causes the topsoil to get compact and becomes barely permeable for the roots, water and oxygen. That results the trees to be left without appropriate amount of water, nutrients and oxygen. It is estimated that urban trees live in this environment only for 7 to 10 years, but with better soil conditions for up to 50 years. The solution used in Stockholm to combat soil compaction is based on a special planting medium, structural soil, and a unique rainwater drainage and aeration system that delivers air and rainwater to the root zone. The so-called artificial structural soil is well compactable, load-bearing and porous.



Water sensitive design in urban open spaces

GREEN INFRASTRUCTURE GUIDEBOOKS 3

In cities, much of the surface is paved, and rainwater cannot drain into the soil, so runoff water becomes a burden on the sewage system. The purpose of water sensitive design is to keep a significant proportion of rainwater in place, reduce surface runoff and increase evaporating surfaces. This way, the fallen precipitation would have a conditioning effect on the area while remaining in the urban water cycle.

CONTENT

water sensitive urban design

The purpose of water sensitive design is to achieve a sustainable, rainwater management based on the natural water cycle instead of fast discharge. Retaining the water on-site has numerous positive effects on the urban environment, such as flood mitigation, reduction of the surface and air temperature and thus improving the comfort of residents.

tools

Elements of sustainable rainwater management can be applied individually, but significant impact can be achieved through their combined application at city level.

domestic and international examples

Domestic examples include mostly individual rainwater management solutions, while foreign examples illustrate complex city-scale solutions.

TECHNICAL PRINCIPLES FOR WATER SENSITIVE DESIGN

CONVEYANCE

The use of open drains returns water back into the cityscape, enhances the evaporation and makes water management perceivable for the residents.

INFILTRATION

The infiltration of a green area or permeable pavement decreases the urban runoff and recharges the groundwater, providing water for the urban vegetation.

DETENTION

The temporary retention of rainwater helps to decrease flood risks, and release the sewage system by reduction of the peak flow.

CLEANSING

Green inrastructure can supplement the cleansing of polluted urban runoff by the natural processes of sedimention, filtration and biological uptake.

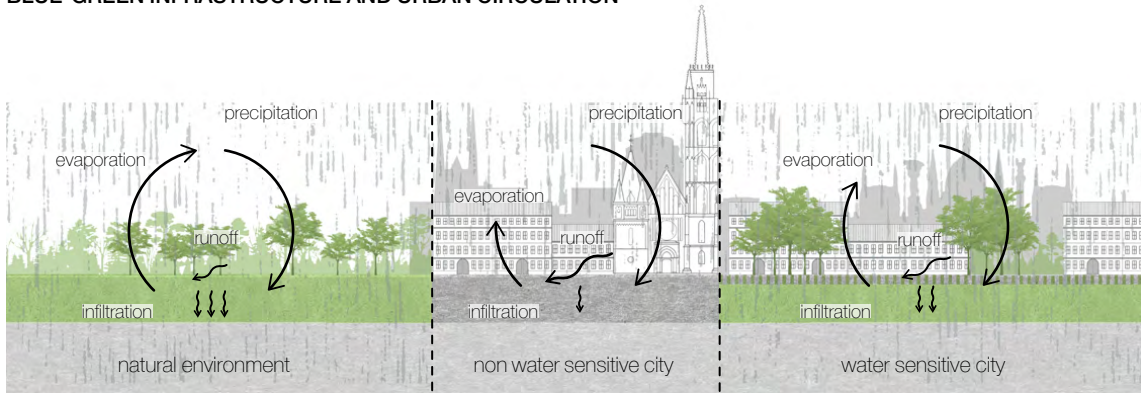
RETENTION

If an area is not suitable or large enough for infiltration, retention too can keep rainwater on site and enable its reuse in buildings or for irrigation.

EVAPORATION

By evaporation, rainwater can be returned to the water cycle. It can also be used where watertight pavement or high groundwater prevents infiltration.

BLUE-GREEN INFRASTRUCTURE AND URBAN CIRCULATION



Elements of sustainable rainwater management are part of the water infrastructure and their dimensioning therefore requires water engineering expertise. To reach the highest synergies of ecologic and livable urban planning, it is advisable to involve a landscape architect into the design process. As a result, drainage elements, reservoirs and infiltration surfaces can appear as an integrated part of the urban landscape and can even serve as recreational areas of a city.

WATER SENSITIVE PLANNING
outdoor design toolbar

CITY LEVEL

- Extension of blue-green infrastructure
- Water features
- Infiltration on green areas and permeable pavements
- Means of water transfer
- Street tree planting

NEIGHBOURHOOD LEVEL

- Retention ponds
- Cleansing wetlands

PROPERTY LEVEL

- Green roofs
- Blue roofs
- Green facades
- Infiltration swales
- Drainage swales
- Underground infiltration
- Water harvesting tanks

Green facades

GREEN INFRASTRUCTURE GUIDEBOOKS 2

Green facades have a positive impact in areas where traditional green surface technologies have not enough space. The guidebook presents solutions based on the use of traditional climbing plants and modern green walls, where the root zones of plants are attached to the facade plane by various technical solutions.

CONTENT

significance of green facades

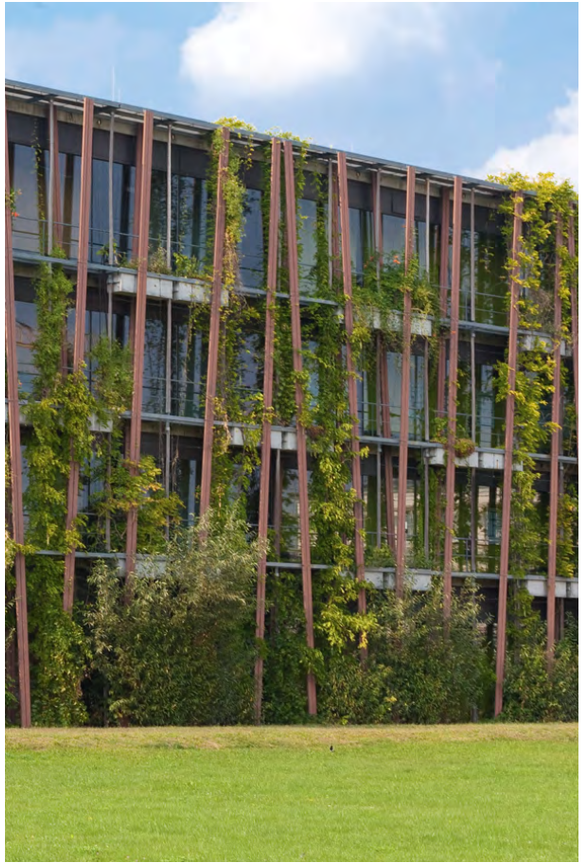
Green facades have many favorable features, but their real significance lies in the fact that they can display these features in areas where no other green infrastructure element is applicable.

types and technical solutions

Based on applicable plants and technical solutions, the guidebook introduces, among other things, the traditional climbing plant implementation, planter row and vertical root zone systems alike.

design and implementation

Before applying green facades, it is necessary to evaluate the following aspects: planned architectural purpose, environmental and technical features, operability, legal and financial background, building qualification criteria, social aspects and quality of life.



GREEN WALL
as a living facade

Green walls in cities provide diverse and highly valuable services to the environment, city dwellers and users of buildings. Unlike air conditioners, vegetation can cool the interior of a building and the street at the same time - while providing numerous health, ecological and technical benefits. The environment has a significant impact on the physical and mental performance of citizens and is one of the main determinants of the city's competitiveness. The healthy environment is fundamentally influenced by the specific climatic impacts in the settlements.

BENEFITS OF GREEN WALLS

microclimatic effect

reduce urban heat-island effect • improve the urban microclimate

clean air

binding of fine dust • binding of gaseous pollutant • oxygen production

biodiversity

increase urban biodiversity

socio-economic role

aesthetic value • increase in real estate value

technical advantages

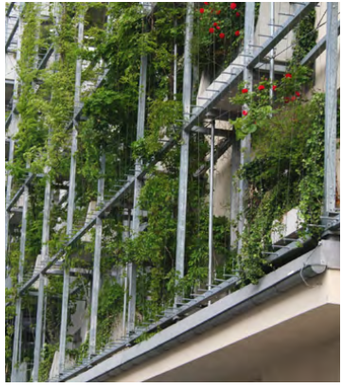
rainfall protection • energy role • increase longevity • sound insulation

example 1 - felt / cassette system

In case of vertical root zone systems, the root zone is placed vertically, before the facade plane, forming a contiguous surface. The plants palette can be extremely diverse.

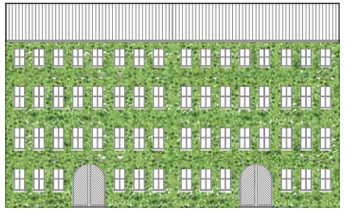
example 2 - hanging plants

Hanging plant pots at any level of the facade can provide a nice surface as a „green curtain" and do not require a supporting structure.



example 3 – climbing plant facade

An essential feature of climbing plants is the form of clinging, which determines the type of green facade to use. There may be species that require support and others that do not require support.



Permeable pavements

GREEN INFRASTRUCTURE GUIDEBOOKS 1

Nowadays, the cooling of the city consumes more and more water and energy, while the falling rainwater goes to the rivers unused. Through permeable pavements, the water that infiltrates into the soil can be absorbed by urban vegetation, improving it's water supply and evaporation, thereby significantly cooling it's environment.

CONTENT

urban rainwater drainage

Permeable pavements allow some of the rain to infiltrate into the soil, reducing the amount of water entering the drains and thus reducing the load on the drainage system.

permeable pavement types

The superstructure and the substructure of the permeable pavements must have a particle composition that allows water to flow through the pores between the particles.

outstanding examples

By presenting domestic, accomplished and well-functioning locations and solutions, the guidebook provides insight into the practical application of permeable pavements.

DESIGN TOOLS FOR THE FUTURE
in the light of climate change

The main symptoms of climate change in our geographical zone are the increasing frequency and intensity of sudden heavy rainfall and prolonged warm and dry periods. The sudden coming large amount of water overloads the sewage network, which would cause flooding with high material damage. In addition, summer heat waves pose a serious health risk to residents, and reduce the quality of green areas, that can help to improve the urban climate.

BENEFITS OF PERMEABLE PAVEMENTS

relief of drainage system

When using permeable pavements, only a smaller drainage system is needed or in some cases may be completely omitted.

positive microclimatic effect

Urban vegetation can absorb water infiltrating through the pavement and evaporate more, thereby significantly cooling the environment.

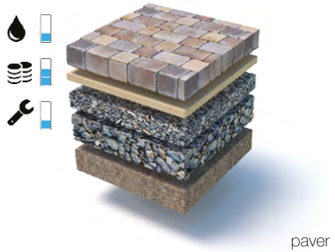
added value

Some pavements also have a noise-reducing function due to the inter-grain gap.

Legend to the pavements: permeability cost maintenance

PAVEMENTS

During the construction of outdoor permeable pavements, after removal of the soil (mirror), the construction of a so-called flexible base, usually crushed stone without binder is built: frost resistant layer and then a load-bearing layer with various thickness depending on the load. Finally, this is where the varied material superstructure, the pavement's weathering layer comes. A pavement is only permeable to water if both the substructure and the superstructure have a particle composition where water can flow through the pores between the particles. The smaller the particle size, the smaller the water permeability.



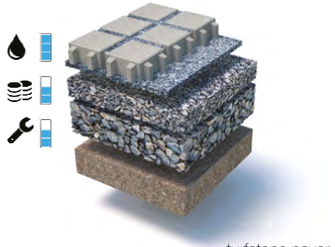
paver

Molded pavements
- Drainasphalt
- Drainasphalt
- Synthetic rubber surface

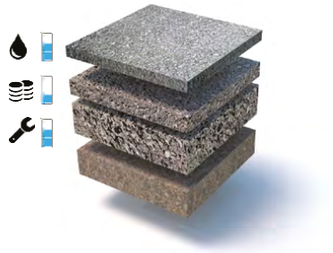
Gravel pavements
- Gravel pavement stabilized with binder
- Gravel pavement stabilized without binder
- Pebble fix

Modular pavements
- Rubble cladding and paver
- Turfstone paver

Pavement with high green proportion
- Stabilized grass paver
- Grass reinforcement

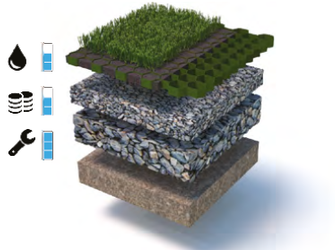


turfstone paver



gravel pavement stabilized without binder

gravel pavement stabilized with organic binder

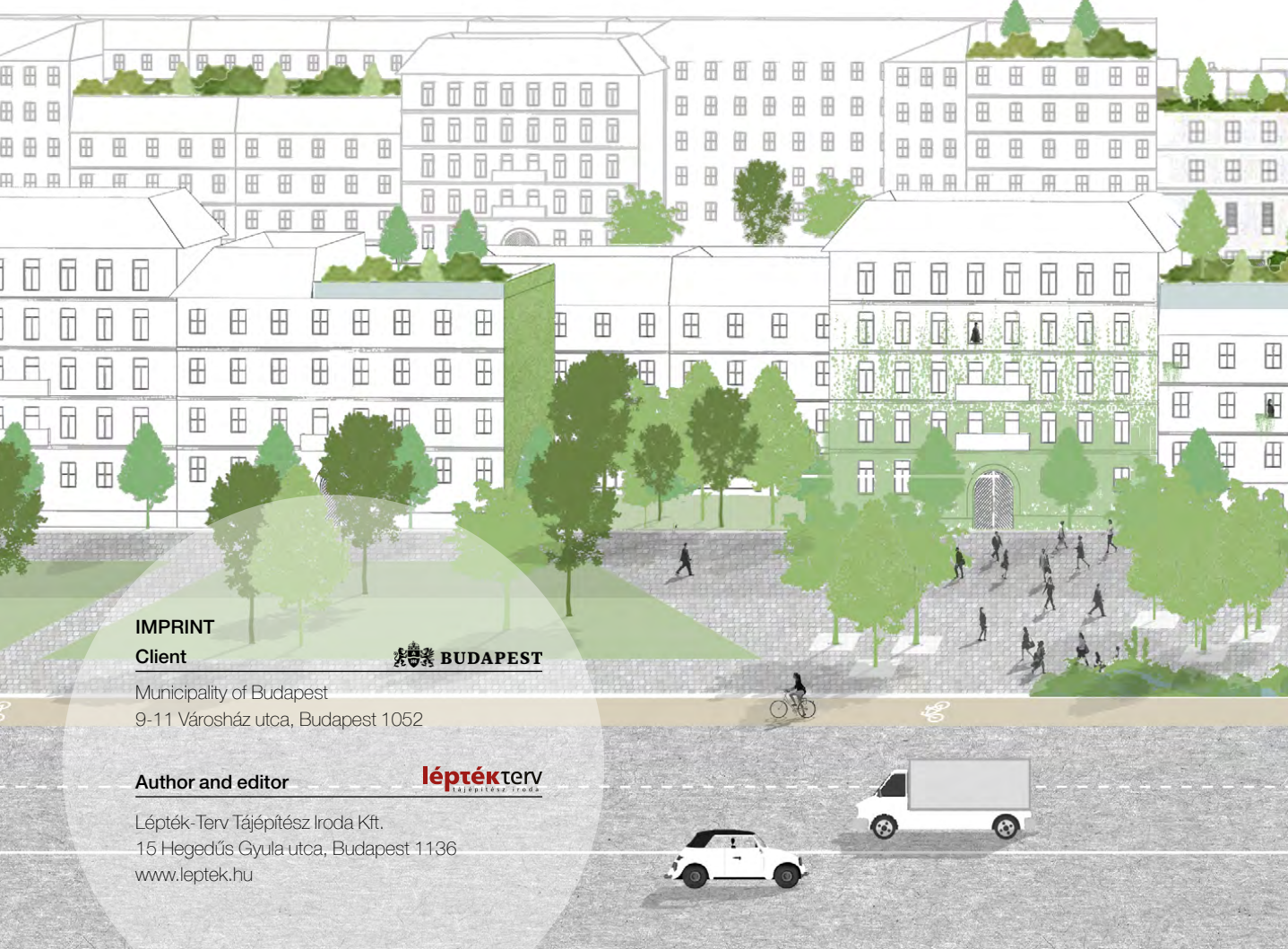


stabilized grass paver

Green Infrastructure Guidebooks published so far

1. Permeable pavements
2. Green facades
3. Water sensitive design in urban open spaces
4. Relationship between urban trees and utilities
5. Renewal of downtown inner courtyards

Online version of the guidesbooks is **available here**



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Client

BUDAPEST

Municipality of Budapest
9-11 Városház utca, Budapest 1052

Author and editor

léptékterv tájépítész iroda

Lépték-Terv Tájépítész Iroda Kft.
15 Hegedűs Gyula utca, Budapest 1136
www.leptek.hu