

# Greenways Systems in Metropolitan Regions as the Alternative for Sustainable Transport Development

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Greenways as linear open spaces in the landscape, planned for multiple usage, can perform significant ecological and social functions as for example: increasing biodiversity, protecting water resources, urban flood damage reduction, wildlife protection, serving as recreational, easy accessed public spaces. Their linear configuration provides an opportunity to unify parts of metropolitan regions dispersed as a result of urban sprawl. Greenways constitute linkages across landscape patches in different planning scales (city, suburbs, exurbs and hinterland scales) for various uses compatible. They help to assist in the revitalization of urban derelict lands, and to change former industrial centres into mixed-use public open spaces oriented to tourism and recreation. The objectives of the paper are: to explore the concept of multi-function of greenways through studies of selected examples of metropolitan areas and to present opportunities to implement urban greenways in local and metropolitan scales. The case studies are analyzed in terms of: location and geographical environment, neighbourhood land, ecological, social and other functions (with emphasize on environmental sustainability). The research results include recommendation for ecologically and socially sensitive development of greenways as the alternative for sustainable transport in highly urbanized environments.

**Keywords:** greenway system, sustainable transport, landscape.

## 1. INTRODUCTION

The data from the World Bank from 2009 indicate the triple increase in the number of urban areas between 2011 and 2030 (Lindfield, Steinberg, 2012). It is estimated that by 2025 among 27 world's megacities, each inhabited by more than 10 million of people, 16 will be located in Asia. The global population of urbanized areas will grow to reach 4 billion (1 billion in the People's Republic of China) of inhabitants in the period of next 15 years (Lindfield, Steinberg, 2012). The rapid urbanization, the fastest one in Asia, swallows new land.

The principles of sustainable development of contemporary cities as urban management, policy integration, ecosystem thinking, cooperation and partnership are indicated in the final report of the EU Commission of Sustainable Communities: "European Sustainable Communities" (1996). Cities as the "interconnected and dynamic systems" effect significantly environment they are

situated in (Beatley, 2000, European Commission, 1996).

## 2. METHODS AND MATERIALS

The rapid and uncontrolled development of cities in the 19<sup>th</sup> century influenced urban planners to introduce the system of parkways in the major USA cities: New York, Boston, Chicago and many others. At the end of the 19<sup>th</sup> century Ebenezer Howard through his original idea of a "town-country" had started the British garden city movement which quickly spread across the world. Although the theory was beneficial for inhabitants – it offered the escape from congested and polluted cities, it resulted in sprawl of urbanized areas far away from the home city. In 1929 Clarence Stein and Henry Wright, basing on their concept of "greenbelt towns", implemented the plan for the Radburn community in New Jersey. The vision was based on integrated self-sustaining communities, surrounded by greenbelts, with a separation of vehicle and pedestrian traffic.

Greenbelts allowed to preserve natural features of land and enabled to control residential development. Planned Unit Developments (PUDs), Planned Residential Developments (PRDs) and Planned Mixed-Use Developments (PMUDs) influenced more compact infrastructure of streets and service system. Low density communities, dominated by hierarchical street system, traffic and parking zones, caused in opposition to expected benefits not only the environmental problems: loss of natural habitat, defragmentation of farm lands and forests, but also high economic costs (Walmsley, 2006). The short-sighted vision of dispersion of urbanization influenced the birth of new initiatives such as: Green Infrastructure, Smart Growth, Transit-Orientated System, New Urbanism and many others.

The objectives of the paper are: to explore the concept of multi-function of greenways through studies of selected examples of metropolitan areas and to present opportunities to implement urban greenways in local and metropolitan scales. The case studies are analysed in terms of: location and geographical environment, neighbourhood land, ecological, social and other functions (with emphasize on environmental sustainability). The studies are based on identifying contemporary greenways by means of the analysis of relevant literature, reports, government and policy documents, conference proceedings and websites of international networks. The research examines the concept of greenways on chosen case studies, describes the pattern of urban form which best suites greenways theory and evaluates current practices. The case studies are analyzed in terms of: location and geographical environment, neighbourhood land, ecological and social and others functions (with emphasize on environmental sustainability)

### 3. GREEN URBANISM TECHNIQUES

Lehman in his book: "Green Urbanism: Formulating a Series of Holistic Principles" (2010) identifies characteristic features which correspond to Green Urbanism. These principles can be grouped into three significant components:

#### *Energy and Materials:*

- energy self-sufficiency
- renewable energy sources REN
- triple-zero framework: zero fossil-fuel energy use, zero waste, zero emissions (from low-to-no-carbon emissions)

- basing on the concept of "closed-loop ecosystem with recycling, reusing, remanufacturing and composting"
- using local materials and basing on local energy and food supply (Lehman, 2010)
- basing on local decentralized energy supply production system
- green grid-based energy system (combination of heat and power generation), solar or wind generation technologies (Lindfield, Steinberg, 2012)

#### *Ecosystem:*

- reduced GHG emission
- urban climate mitigation
- high water quality
- maximization of urban biodiversity
- increase of urban vegetation
- Green Infrastructure (which combines natural, semi-natural and new urban green spaces, Greenways, Greenbelts around cities, urban farms on their edges, vertical farms, green roofs etc.)

#### *Architecture and Urban Planning:*

- compact city with minimal urban sprawl effect
- using the principles of urban ecology
- using the benefits of the location, orientation and context of cities (e.g. for implementation of natural ventilation and cooling)
- planning of urban landscape patterns and ecological processes at multiple scales (Zaręba, 2014)
- providing well interconnected and integrated public transport systems (buses, light railway, bike stations combined with cities strategic parking lots)
- introduce green Transit-Oriented Developments (TOD) (oriented to create compact communities around transport Nodes) (Lehman, 2010)
- create easy accessible, well integrated and compact local communities, introducing urban farms and community gardens located on the edges of the cities
- create a mixed land use, heterogeneous zoning (to allow compatible land uses to be located in close proximity), create a sense of the place, cultural identity, and vibrant communities (Lehman, 2010).

#### 4. GREEN INFRASTRUCTURE, GREENWAYS – TOWARDS THE DIRECTION OF GREENING URBAN STREETS

According to the Communication from the Commission of the European Parliament paper (Brussels, 6.05.2013) Green Infrastructure is: *a strategically planned network of natural and semi-natural areas with other environmental features designed and managed to deliver a wide range of ecosystem services...it incorporates green spaces (or blue if aquatic ecosystems are concerned) and other physical features in terrestrial (including coastal) and marine areas. On land, GI is present in rural and urban settings*". In United States Green Infrastructure is defined as: *"an interconnected network of waterways, wetlands, woodlands, wildlife habitats, and other natural areas; greenways, parks and other conservation lands; working farms, ranches and forests; and wilderness and other spaces that support native species, maintain natural ecological processes, sustain air and water resources, and contribute to the health and quality of life of America's communities and people"*. (Benedict and Mc Mahon, 2002, p. 6). *Green Infrastructure* is generally related to ecosystem services such as water infiltration, flood control, but also is associated with sustainable goals of modern cities, among other technological practices: green alleys and streets and hard and soft permeable surfaces (Zaręba, 2014). Green alleys combine permeable pavements, rain gardens - located in depression to capture rainwater, tree-planting, bio-swales, cistern rain-barrels and green roofs, incorporated to achieve more efficient storm water management (Chicago Green Alley Handbook, 2010). Ahern defined Greenways as: *"networks of land containing linear elements that are planned, designed and managed for multiple purposes including ecological, recreational, cultural, aesthetic, or other purposes compatible with the concept of sustainable land use"* (Ahern, 1995). Greenways differ from Green Infrastructure in three major ways: they emphasize recreation more than ecology, create a landscape linkages, not the comprehensive, well integrated ecological network and are only a part of a framework for growth. Green Infrastructure helps to shape urban form joining ecologically valuable lands with areas suitable for development (Benedict and Mc Mahon, 2002). Platt [1994] identifies typical functions of greenways as: water resource

protection, pollution mitigation, riparian habitat enhancement, increase of biodiversity, flood hazard reduction, improvement of microclimate, reduction of bank erosion and downstream sedimentation recreation, environmental education and noise attenuation.

Multifunctional greenways link settled areas to the open lands with aim of: recreation, improving: environmental quality of highly polluted urban areas, biodiversity, flood prevention and social condition of local communities. Greenways create corridors of "various widths, linked together in a network" which provide access to open land and link rural and urban spaces. (Fabos 1995).

Ahern [1995] emphasizes the multiple purposes role of greenways and highlights their attributes such as:

- the linear configuration (in term of movement and transport),
- multi-scale (in different spatial scales),
- multi-functions (ecological, social, economic functions) and
- the sustainability (in term of balance between functions).

In 1995 Turner [1995] divided greenways into:

- *parkways*
- *blueways* (following waterways)
- *paveways* (located along main pedestrian lines equipped with cafes, small shops, joining pedestrian origins with destinations to provide safe pedestrian routes in urban areas),
- *glazeways* (located in CBD continuous system of office walls, shopping malls and transport interchanges),
- *skyways* (continuous system of green roofs used by inhabitants for jogging, sunbathing, eating etc.),
- *ecoways* (network of ecological places: urban water courses, public utility corridors, parklands and private gardens) and
- *cycleways*<sup>1</sup>.

Charles Little [1990], describes five general types of greenways-divided into:

<sup>1</sup> Turner's proposed to "spend more of the city's transport budget on cycleways than on roads" and to enable functioning of cycleways in temperate climate he recommended to introduce "a network of roofed, sheltered but unwallled cycle paths" (Turner, 1995).

- urban riversides (greenways along rivers, usually came into being as a part of waterfront redevelopment program)<sup>2</sup>,
- recreational greenways (including mainly long distance paths and trails of various kinds, generally link areas of high visual value),
- natural corridors of ecological value,
- scenic and historic routes (mainly along roads, highways or waterways),
- comprehensive greenway systems or networks.

## 5. GREENWAYS AS A URBAN-SUBURBAN-HINTERLAND JUNCTION - THE CASE STUDIES

Ecological heterogeneity can be manifested at different levels and scales (for metropolitan region functional components include: green space site, neighbourhood, section of the city and urban landscape of the whole city and metropolitan area (Flores et al, 1998). The examples listed below: the Green Chain, the Indianapolis Greenway System, the Metropolitan Greensward represent a type of greenways named “comprehensive greenway systems or networks” whose main function is to connect open spaces across urban, suburban, exurban and hinterland scales.

## 6. THE GREEN CHAIN, LONDON

The Green Chain was launched in 1977 by the Green Chain Joint Committee in cooperation with Greater London Council to safeguard recreation potential of open spaces located in the form of chain in the area of South East London (Turner, 1995). Green Chain Walk – strategic recreational footpath was planned as a continuous walkway joining the South East London chain of parkland. Nowadays, the Green Chain Walk stretches from the River Thames to Nunhead Cemetery and joins the 300 Green Chain open spaces: fields, parks and woodlands across 50 miles of the area. The Green Chain idea, inspired by the work of Frederick Law Olmsted<sup>3</sup> and the greenway concept, returns to the

<sup>2</sup> Urban riversides can be formed not only by riversides, but also along flood belts, river corridors and wetlands.

<sup>3</sup> Frederick Law Olmsted concept of parkways and projects of connecting different urban parks by systems of boulevards and roads with tree lines, demonstrated the need for comprehensive open spaces systems with an emphasize on environment protection (e.g. Boston's Emerald Necklace and parkways systems: in Buffalo, Illinois).

1944 Abercrombie Plan, which main goals were to create a network of greenways linking open spaces in central areas with those located in urban fringe of the Greater London (Zareba, 2010). His visionary plan was based on principles of making possible for “the town dweller to get from doorstep to open country through an easy flow of open space from garden to park, from park to parkway, from parkway to green wedge and from green wedge to Green Belt” (London County Council 1944, Turner 1995).

## 7. THE INDIANAPOLIS GREENWAY SYSTEM

The beginnings of the greenway system in Indianapolis, inspired by the City Beautification Movement, flourished in the last decade of the 19<sup>th</sup> century, date back to John Olmsted and George Kessler master plan for parks and boulevards. The plan was completed in 1909, although not entirely implemented (only few parks and parkways along streams were built), and it gave guidelines for the new master plan adopted in 1994 and updated in 1999 (Lindsey, 2003). The final plan included guidelines connected with 14 new greenways (4 of which were recommended in the plan from 1909). The greenway system of broad accessible trails for recreation and conservative corridors (mainly in private ownership, without public access) included river, streams and canal towpaths from 1836. When completed, the system of greenways will incorporate 175 miles of trails and 4,700 acres of open space (Lindsey, 2003).

## 8. A REGIONAL PLAN FOR THE NYCMA – METROPOLITAN GREENSWARD, NEW YORK

NYCMA (New York City Metropolitan Area) covers the area of 41,000 km<sup>2</sup> in three states: New York, New Jersey and Connecticut and includes 31 counties and metropolitan areas with high density cities, surrounded by rings of extensive suburbs. Regional Plan for the NYCMA – Metropolitan Greensward, link urban green spaces with regional nature reserves into one, comprehensive green space system (Flores et al, 1998). In this way it helps to restore the whole landscape mosaic and nature environment for the region's cities, suburbs, agricultural lands, forests and nature reserves. The Metropolitan Greensward strategy has three principal objectives: create regional reserves to delimit expansion of the cities and preserve the

most significant ecosystems, water resources and grounds for recreation; improve the urban parks, public spaces and natural resources in cities and to provide easier access to park land; create a network of greenways which connects cities, suburbs and protected landscapes. The Metropolitan Greensward identifies landscape features of NYC region as: the urban matrix at the metropolitan area with green spaces in highly managed parkland; “the large unfragmented ‘natural’ landscapes in ex-urban hinterlands”; and “the corridors of green space that run throughout the urban, suburban, and rural communities” (Flores et al, 1998, p.302).

## 9. CONCLUSIONS

The comprehensive greenway systems planning has its roots in the 19<sup>th</sup> century Urban and National Park Movement, which was initiated in 1858 with the early example of the Olmsted and Vaux plan for Central Park in New York. The general idea of the urban park movement was to bring nature into fast sprawling cities and to create outdoor recreation for the urban citizens. After the first great success with realization of Central Park in New York, Olmsted designed the Boston Emerald Necklace and created the first in the urban planning history comprehensive park system - the first greenway in America, which stretches for 10 miles from Franklin Park to the Charles river. From that point the urban park movement spread into major cities in the United States. From the late 1960s greenways were used in USA as alternative trails to congested streets and highways. In 1987 the President's Commission on American Outdoors for the United States summarized the greenway planning epoch and defined greenways as the basic linkages joining rural and urban green spaces which constitute parts of the great circulation system.

Maintaining ecological connectivity, defined as the continuous flow of energy, species and matter, is crucial in a metropolitan, highly fragmented landscape. Without connectivity, green spaces become isolated and lose their ability to sustain themselves. One of the attributes of greenways is that they realize, following Ahern definition, a synergy based on linkages across special scales. These make the greenways a planning tool available to transform the whole landscape in urban, suburban and hinterland scales. The greenway network allows to create sustainable urban development which could be environmentally and socially favourable. Green

spaces soften the impact of transport on climate change and open up possibilities for clean and safe regional transport.

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