

Evaluation of Urban Open Spaces Sustainability

Jiri Palacky^{1,a}, Maxmilian Wittmann^{1,b}, Lubos Frantisak^{1,c}

¹ Brno University of Technology, Faculty of Architecture

^a palacky@fa.vutbr.cz, ^b wittmann@fa.vutbr.cz, ^c frantisak@fa.vutbr.cz

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Abstract

Urban open spaces have been gaining in significance in an unprecedented fashion in recent years. Their character, quality, state, and variability directly affect the development or, conversely, the decline of the urban environment, thereby directly impacting quality of life and the willingness of urban populations to identify with their surroundings. Open spaces also play an essential role in the sustainable development of cities.

Following the condition of open spaces and continuing to support their development in areas which are found to be stagnating are imperative. These areas of potential worth and unique merit can be characterized and quantified. In the process, it becomes possible to continuously monitor the influence and effectiveness of planning measures on the quality of real spaces inside cities from the standpoint of sustainable development.

Using a wide selection of sites, we will establish locally and universally applicable characteristics of urban open spaces, related to their historical, economic, ecological, and social potential. We will also attempt to demonstrate their immediate effect on sustainable urban development and quality of life. The results will contribute to the development of the theory of sustainable urban development and urban open spaces.

1. Introduction

The protracted worldwide financial crisis, which began with the stock market plunges, bank bailouts, and high unemployment of 2007 – 2009, has had a significant impact on the importance and development of urban open spaces. In any number of European and American cities, socioeconomic and environmental changes have become the driving force behind a series of visionary projects aimed at regenerating and improving the surroundings of urban inhabitants with the goal of reversing the negative impact of an unfavorable economic climate. Urban planners, architects, economists, sociologists and ecologists are working together to capture the imagination of urban dwellers and encourage them to invest their energies and capabilities in establishing healthy, society-friendly, and environmentally friendly urban development.

2. Research background

Urban open spaces form an urban ecosystem, which is open to a wide array of users and is held together by an intricate web of social and economic relationships. At the same time, these spaces represent important centers of sustainable urban development. When examined from this vantage

point, the character, quality, and condition of open spaces have a direct impact on the development (or, conversely, the degradation) of the urban environment and on whether communities tend toward homogenization or diversification. These factors, in turn, directly affect the well-being of the local residents and their willingness to become active participants in the transformation and development of their surroundings. Open spaces, therefore, play an irreplaceable role in the sustainable development of cities.

Yet another role which open spaces play in the urban environment is that of nodes in the network of urban greenery. The results of research conducted in the year 2006 on a sampling of fifty-five cities in the United States (Nowak, Crane, & Stevens, 2006) have proven the efficacy of urban greenery in removing pollutants from the air. Urban open spaces with 100 percent greening are responsible for a two percent improvement in air quality during the course of the day (when the trees are in leaf) as they remove airborne particles such as ozone and sulfur dioxide from the air. Retention of rainwater, reduction of noise pollution, and regulation of air temperature are other functions of urban greenery which improve quality of life in the area.

Research conducted over the last fifteen years in Belgium (Van Herzele & Wiedemann, 2003) has shown that when quality open spaces are lacking, as was the case with the city of Leuven and its dearth of playgrounds and parks, families (especially those with young children) prefer to move to quiet, natural locations on the outskirts of cities to build their homes, thus contributing to higher levels of suburbanization.

In terms of social sustainability, other research (Wolch, Byrne, & Newell, 2014) shows the need to ensure free access to open spaces across the widest possible spectrum of the population. Access is crucial not only during the periods of recovery and implementation but for the long term as well.

Post-industrial spaces have also benefitted from the use of greening as a tool for renewal. Greening is currently being employed in the urban planning strategy of New York City, for example. A developmental plan called VISION 2020: New York City Comprehensive Waterfront Plan (Bloomberg, 2011) was created in response to a lack of open spaces. The goal of the plan is that the majority of New Yorkers will live within ten minutes of an accessible waterfront recreation area. Strategies for achieving this goal include renewal of parks, open areas, and plazas, greening of streets, planting of trees by volunteers, and renewal of the waterfront. In the year 2014 alone, forty-four hectares of new park lands came into being through the renewal of wetlands and river banks.

Another example of renewal in a post-industrial area in Brooklyn demonstrates a consciously creative approach to the development of sustainable urban open space. Middle-class inhabitants of the Greenpoint neighborhood formed the Newton Creek Alliance, named after one of the most polluted industrial sites in the US. Their goal was to improve the quality of open spaces without destroying the industrial spirit of the neighborhood. Using a “just green enough” strategy, the Alliance was able to make a stand against developers and prevent another case of environmental gentrification (Curran & Hamilton, 2012).

Yet another example in which significant investment in greening has played a major role in the gradual renewal of a post-industrial open space is that of the New York High Line. A campaign initiated by two local men, J. David and R. Hammond, successfully blocked the intended demolition of the defunct railway construction and led to the creation of a dynamic public park with a decidedly industrial flavor. However, in this case developers took over, and with the

construction of luxury high-rise buildings in the immediate vicinity, middle- and lower-income residents have been steadily pushed out of the area.

3. Hypotheses

Our research derives from the hypothesis that urban open spaces can be perceived as areas of potential capital and unique worth. As such, these spaces can be characterized, and their influence on sustainable urban development can be quantified by means of various indicators. By analyzing trends and observed values, we will be able to create models of development, which can be used to positively impact the quality of real spaces in cities from the standpoint of sustainable development. We likewise expect the results of our research to contribute to the development of workable theories of sustainable development of cities and their open spaces.

4. Methodology

Our research is based on a diverse sampling of locations for which we will determine locally and universally applicable characteristics, related to their historical, economic, ecological and social potential. We also aim to demonstrate the immediate effect of these characteristics on sustainable urban development and quality of life. The transformative projects, both at home and abroad, which will become the focus of our study, will provide us with an inspirational image of the metamorphosis of urban areas while allowing us to draw conclusions generally applicable to other cities facing similar challenges.

This paper opens with a description of the focus of our research as it pertains to open spaces with the aim of identifying the significant characteristics that influence quality of life as well as sustainable urban development. The foundational step of our research has been to define the very concept of open space. In the next chapter we describe the general characteristics of open space, defined with respect to the three pillars of sustainable development. Selected characteristics are then applied to case studies in housing estates in Brno, Czech Republic. Subsequently, we outline the next phase of our research and present a selection of case studies in the cities of Graz, Austria, and New York City, USA. In the final section, we provide a working list of anticipated indicators, the specifications and interrelations of which we will explore in subsequent years, along with the evaluation of their impact on urban development.

5. Urban Open Space

For the purposes of our research, we have broadly defined Open Space as outdoor areas, originally of natural character, which are located between or among buildings due to subsequent urbanization of the area. As part of the urban landscape, such spaces have a significant impact on the quality of life of urban inhabitants.

We have further narrowed the scope of our research to those spaces which occur in residential areas of large Central European cities, including cities in the Czech Republic. Our research also includes selected examples of open spaces situated in the center of metropolitan New York, the most densely populated urban agglomeration in the world. This is where demands on quality of life are the highest, directly touching the greatest number of inhabitants.

Concerning the emergence of open spaces, our research focuses on residential areas that have come into existence in the last twenty-five years. The research methodology we have defined within the scope of this project will also be used (for comparative purposes) on older housing estates,

specifically prefab high-rise apartment complexes, constructed between the years 1962 and 1989, in the city of Brno, Czech Republic.

For the purposes of our research, we have also defined Open Space as occurring within a built-up urban area, situated among primarily residential buildings or in their immediate vicinity, with a maximum built-up area of ten percent within the boundaries of the space itself. A meadow, a park, or similar green spaces may also constitute an Open Space. Our definition also includes areas in the transitional zone between residential buildings and the area in their immediate vicinity (the so-called soft boundary line) made up of small front lawns, gardens, and courtyards, as well as green areas utilized for informal markets, recreational activities, and night life (Alexander et al., 1977; Gehl, 2013). The flexibility of such spaces allows them to function as urban catalysts (Oswalt, Overmeyer, & Misselwitz, 2013). They are places of innovative cultural production, tempting to the eye, with a wealth of detail. At the same time, open spaces can be public, semi-private, or private in character, both from the perspective of ownership and that of accessibility.

With the exception of Palavske Square (Brno – Vinohrady, Site 1) spaces which are primarily associated with transportation (streets, squares, and parking lots) have been excluded from our research.

6. Characteristics which impact quality of life and sustainable development

For the purposes of our research, we have distinguished between three sizes of cities: large cities with more than one million inhabitants (New York 8,491,079 and Prague 1,243,201), mid-sized cities with between one hundred thousand and one million inhabitants (Graz 269,997, Bratislava 491,061, and Brno 385,913) and small cities with fewer than one hundred thousand inhabitants. Each open space in the study is then assigned a territorial index to which observed characteristics and measured or detected indicators and their values refer.

Territorial indices:

A – area of the assessed open space

B – a block or open area, including neighboring buildings

C – locality, neighboring area with comparable characteristics

D – neighborhood, district, town

In order to locate the assessed space within the city structure we distinguish between: city center, city proper and periphery. Individual characteristics of the open spaces are then applied to the social, economic, and environmental pillars of sustainable development.

6.1 Characteristics of Open Space in terms of social sustainability

In its broadest sense, social sustainability can be explained in relation to the number of visitors to a particular place whether from different demographic groups or the predominant population. Where visitors are lacking, decline is inevitable. In a narrower sense, social sustainability can be more diverse as it includes gender, age, income, and ethnicity. With increasing diversity, however, comes the potential for conflict. Conflict leads to security issues making personal security another important indicator of sustainability. Additional characteristics relating an area A to neighboring buildings (areas B and C) are ownership, spaciousness, and condition of facilities. These factors especially influence how public spaces are used by providing space for activities for which the surrounding dwellings are not suitably equipped.

6.2 Characteristics of Open Space in terms of economic sustainability

Case studies in New York City (specifically the High Line and Bryant Park) will provide the foundation for studying the various manifestations of economic sustainability, especially as it relates to a rise in property values, which is often connected with the recovery of public spaces. Also of interest is the question of funds for the continued maintenance of regenerated areas.

Economic sustainability is basically a matter of achieving balance. It involves using available resources in a way that allows a system to continue to operate effectively over a period of time. The vast majority of renewal projects begin with the idea of improving an existing area for the benefit of the people who live there. Occasionally a particular project, for its uniqueness or innovative approach to a problem, attracts the attention and capital of “outsiders” (developers and investors, for example). At first this may seem like a positive development; however, the weight of the outside investment gradually changes the economic balance of the area, eventually leading to gentrification sometimes called ecological gentrification. In such cases, the regeneration process has not led to economic sustainability of the original community.

Economic sustainability is relevant not only in the initial stages of regeneration but also in relation to maintenance or upkeep of the regenerated area. An interesting example is Bryant Park. Much of the park’s history has comprised cycles of decline and subsequent regeneration. For this reason the current management (Bryant Park Corporation, a non profit private management company) has chosen to find ways to generate revenue for continued upkeep from the park’s cultural offerings in an effort to maintain economic sustainability.

6.3 Characteristics of Open Space in terms of ecological sustainability

Urban open spaces provide adequate green areas for physical activity and so contribute to the health of the urban population. As part of the urban ecosystem, they also make a significant contribution to safeguarding biodiversity. A number of cities are initiating programs to support the creation of parks with the aim of rejuvenating neighborhoods burdened by brownfields and unused transportation infrastructure. When greening leads to gentrification, as we mentioned earlier, the very people who were meant to benefit are instead forced out of the area. It is therefore imperative that urban planners, architects, and ecologists continue to search for new strategies which will establish a balance between ecological and social sustainability (Wolch et al., 2014).

Cities are actively seeking balance and harmony between the natural and the urban areas of which they are made. A number of locations have had positive experiences with grassroots movements, which seek to improve public spaces using strategies such as community gardens and volunteer tree planting. Where community support is missing, public spaces often fall into neglect.

6.4 Internal and external characteristics of Open Space

Individual characteristics can be grouped into two sets of parameters: external, in relation to area B (respectively C or D as well), and internal, in relation to area A.

The following are included in the set of external parameters: location (with respect to population, with respect to residence), description of the city (urban structure, average building height, architectural quality, condition of buildings), and functional context (interactions, precedence of personal vehicles, public transportation connections).

Internal parameters include: space (size, boundaries, shape, and condition) and facilities (proportion of vegetation, number of trees, area covered by water, proportion of parking spaces, services for personal vehicles, play areas, public facilities, lighting, small buildings and artwork, advertising).

Internal parameters influence factors such as appearance of the surroundings and the environmental quality, ease of orientation, visibility, security, and social controls. They also influence the utilization of open spaces and their subsequent maintenance.

7. Case studies, Brno, Czech Republic, Vinohrady and Lesna

Work on the case studies outlined in the following text will commence in September 2015 and will be completed in June 2016. The following are examples of mid-rise, prefab apartment complexes, located on the outskirts of the city of Brno in the Czech Republic. Of the five sites, four are located in Brno – Vinohrady and one in Brno – Lesna.

The housing estate Brno – Vinohrady (authors: J. Dolezal, M. Dufek, A. Janecek and P. Plsek, project leader: J. Dolezal, chief project engineer: V. Vanek) was built between 1981 and 1989, commercial facilities were in place by 1992 (Doležal, 1980). Vinohrady was one of the last housing estates to be built in Brno and is distinguished by its purely rational orthogonal urban structure with regularly recurring types of buildings. This area also has the highest population density in Brno.

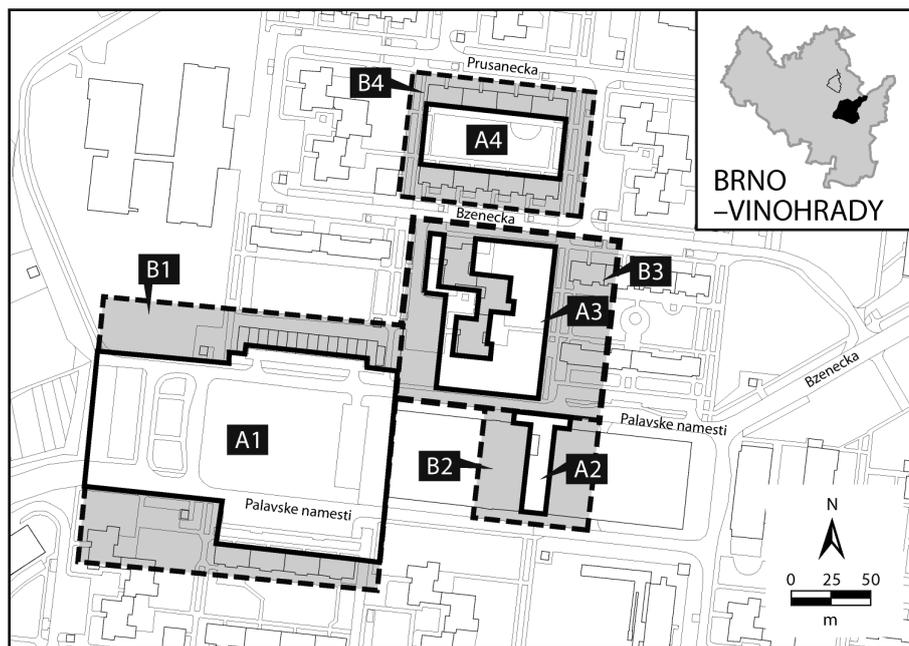


Figure 1. Location of case study areas in Brno–Vinohrady. Source: cartography and GIS by authors, based on MMB cadastral map.

Brno – Lesna (authors: F. Zounek, V. Rudis, M. Dufek and L. Volak) built between 1962 and 1970, was the first major housing estate in Brno. At the time of its inception, the settlement was subject to both criticism and admiration. Along with the Brno Exhibition Grounds, it was the largest and most radical structural intervention since the demolition of the city walls in the mid-19th

century. It is considered one of the most successful implementations of the concept of the garden city (free modernistic buildings surrounded by greenery) in the Czech Republic. The center of Lesna is broken by a large wooded area, crisscrossed with walking trails, called Certova Valley, and there are large parks between individual buildings. The arrangement of prefabricated apartment houses is based on the morphology of the terrain and does not form a regular grid. The main road circles the perimeter of the neighborhood with short branch roads providing access to the surrounding buildings. The majority of the buildings and services are located within the traffic circle.



Figure 2. Brno–Vinohrady, Case Study 4, 2015. Photo: S.Kubinova.

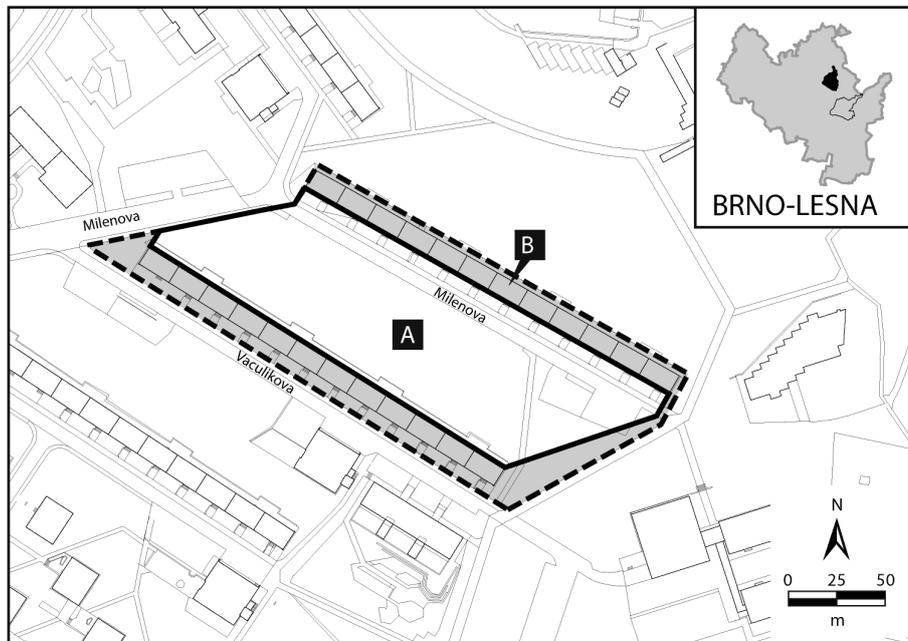


Figure 3. Location of case study area in Brno–Lesna. Source: author's presentation based on MMB cadastral map.



Figure 4. Brno–Lesna, Case Study 5, 2015. Photo: J.Palacky.

8. Case studies, Graz, Austria, Mariatrost, Tannhof I and II

The following are examples of residential complexes, located on the outskirts of the city of Graz in Austria. The two sites, Tannhof I and Tannhof II (author: German architect Hubert Ries), were built in the Mariatrost neighborhood between 1989 and 1990 (Szyszkowitz & Ilsinger, 2003).

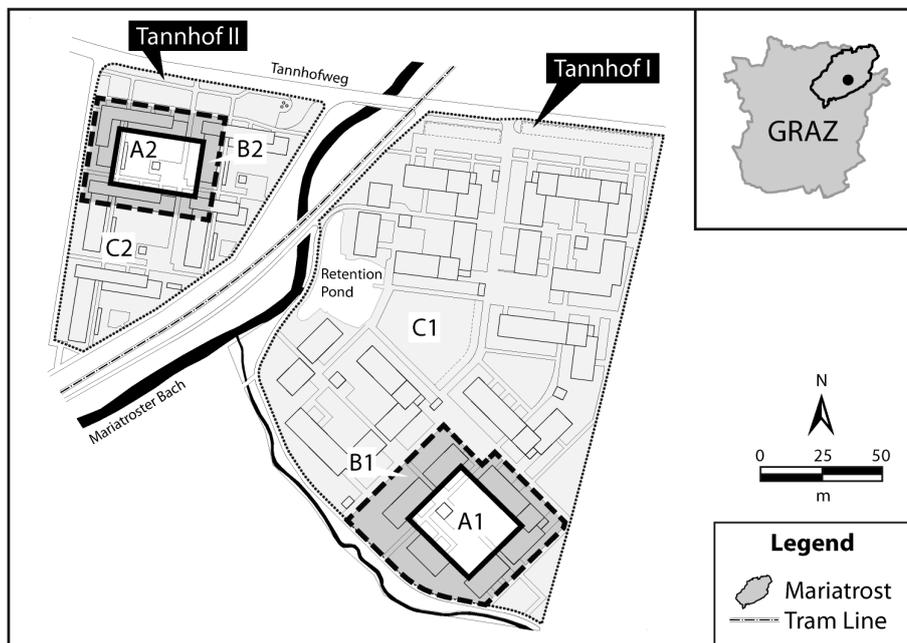


Figure 5. Location of case study areas in Graz–Mariatrost. Source: author’s presentation based on OpenStreetMap.

Tannhof I consists of five residential blocks, which are symmetrically arranged around a large meadow with a playground and a retention pond. Each of the five blocks has a small, central

clubhouse, containing, among other things, mailboxes for all of the apartments. Each block consists of one to three-story apartment houses. Apartments on the higher floors are accessible by the characteristic external covered staircases. There are between eighteen and twenty-two apartments in each of the block, totaling one hundred units in the entire complex.

Apartments on the ground floor feature front gardens which are bordered by a hedge on both sides of the houses. These gardens connect to a common area in the center of the apartment block on one side as well as to open space on the outside of the apartment block on the other side. The outside area is accessible only to residents of the complex.



Figure 6. Graz–Tannhof I, 2005. Photo: L. Frantisak.

A tram stop, located right next to a pond, can be found between the two residential complexes. The tram lines, as well as a path for pedestrians and cyclists, follow the path of a creek as it leads toward the city. Tannhofweg Street provides motor vehicles access to the complex. There are parking spaces both under pergolas and in an underground parking garage, including spaces for motorcycles and bicycles. Each apartment also has a small wooden shelter for bicycles and garden tools.

Located on the right bank of the creek is Tannhof II, two years younger than its sister complex. Tannhof II also consists of five residential blocks composing an L-shape; however the newer complex is more spatially efficient. It combines two- and three-story row houses and apartment houses, five blocks in total, which share three community centers, clubhouses with bicycle booths, and children’s playgrounds. The community also shares an underground parking garage, central heating, and an area for recycling and disposing of garden waste. Common and private space is delineated by hedges, while at the same time the areas of the complex are connected by sidewalks. Access staircases for apartments on the second and third floors are supported by concrete columns. Motor vehicle access as well as access to the tramline and bike path are the same as for Tannhof I.



Figure 7. Graz–Tannhof II, 2005. Photo: L. Frantisak.

9. Case studies, New York City, USA, Manhattan, the High Line and Bryant Park

The following are examples of city parks that emerged from the regeneration of previously neglected areas. The High Line and Bryant Park are both located in the Midtown Manhattan neighborhood of New York City, USA.

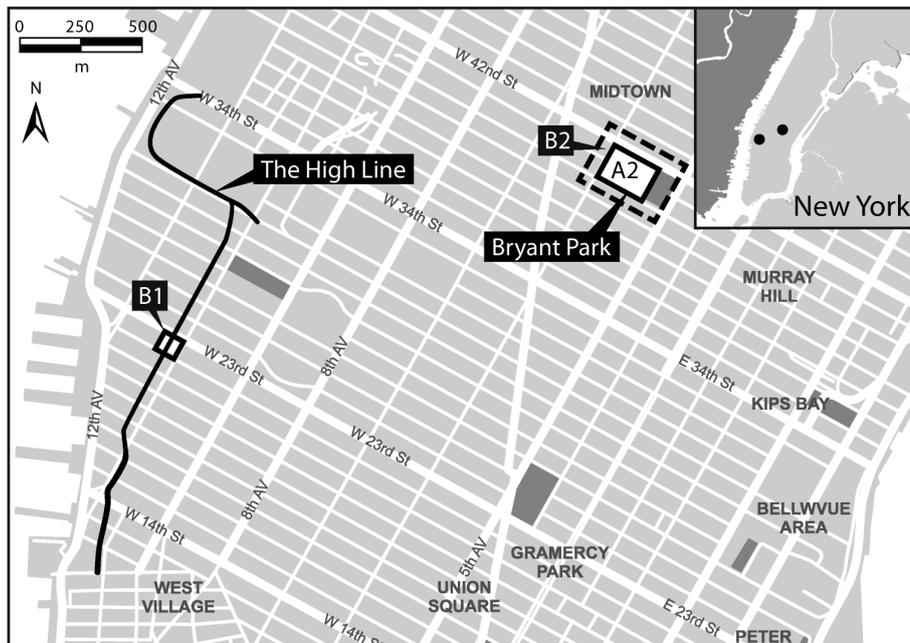


Figure 8. Location of case study areas in New York City, Midtown Manhattan. Source: author's presentation based on New York Map by dikobraziy/Shutterstock.

9.1 The High Line

The High Line is a former elevated freight railway from 1934 that supplied the industrial area of Manhattan's West Side. The closing of the structure in 1980 marked the start of a period of decline and plans for its removal. It was saved from demolition by an ambitious economic plan on the part of local residents J. David and R. Hammond (founders of the non-profit organization Friends of the High Line). The plan proposed that the defunct railway be transformed into a new open public space in the form of a linear park. Reconstruction of the 2.4 km structure was carried out in three stages, from 2006 to 2014, according to the winning design proposal, submitted by James Corner Field Operations (project lead), E. Diller, R. Scofidio, Ch. Renfro (designers) and P. Oudolf (planting designer). The realization of the project was overseen by the New York City Economic Development Corporation, in cooperation with the NYC Dept. of Parks and Recreation, the NYC Dept. of City Planning, the Office of the Mayor, and Friends of the High Line (David & Hammond, n.d.). The organization Friends of the High Line annually raises funds which support more than seventy percent of the park's operating costs.



Figure 9. The High Line, W19th St. view of Hell's Kitchen, June 2011. Photo: J. Palacky.

Today the High Line is an attractive park/promenade, providing spaces for spontaneous theater presentations, secluded meeting places, exhibits, and social activities year round. Like the Charles Bridge in Prague, it entices visitors from all over the world to enjoy its unique atmosphere again and again. Owing to the preservation of the original railway construction and costly investments in its renewal, the High Line has also attracted intense attention from investors, who have entrusted the realization of cultural institutes, luxury high-rise hotels and apartment houses into the hands of prestigious architects. The latest example is the New Whitney Museum of American Art (between 10th Ave and the High Line) by Renzo Piano. It will open in May of 2015. Some of the luxury apartment buildings in close proximity to the High Line erected in the course of the last few years include The Standard High Line Hotel (Meatpacking District), the High Line 23 by Neil-Denari (Chelsea Arts District), the 505 West 19th Street by Juul-Hansen, the 520 West 28th Street by Zaha

Hadid, the 551 West 21st Street by Norman Foster, and the 515 Soori High Line by Soo Chan (Budin, 2014).

This rapid development has wrought changes in the quality of the space itself, which had been characterized as providing pedestrians with peaceful, bird's-eye views of Manhattan and the Hudson River. As property values and population have risen, the image, character, and social structure of the area are gradually changing and a new, distinctive identity is evolving. All this has led to gradual, inevitable environmental gentrification (Patrick & Kowalski, 2011).

It is not only the magic of the High Line but also the innovative and community-driven approach that has inspired a growing number of similar projects in other areas of the United States. These derivative projects have also managed to successfully implement the public-private financing partnerships, but what is more, they have re-created the strong involvement of community supporters. Among the most interesting are the Bloomingdale Trail in Chicago (recently renamed The 606), a former 4.5 km regenerated railway; the Atlanta Beltline, a 35 km regenerated railway which circles the downtown area (McMillan, n.d.); and the Jersey Embankment, a 1 km public park overlooking the Hudson River waterfront, situated on a historic structure that was once part of the Pennsylvania Railroad Freight Way.



Figure 10. Bryant Park, June 2011. Photo: Andrew F. Kazmierski / Shutterstock.com.

9.2 *Bryant Park*

Bryant Park, named in memory of poet William Cullen Bryant, was built in 1842 on Reservoir Square near the western wall of the former water reservoir, which is now the New York Public Library. The New York Crystal Palace was installed there in the years 1853-1858 to house the World Industrial Exhibition.

The park was partly closed as a result of construction of the subway line at 42nd Street and fell into decline during the 1920s due to negligence. A park regeneration competition in 1934 led to the park's being rejuvenated, grassed, fenced off and equipped with a fountain. In this state it was occasionally used as an open-air reading room for the adjacent library until the advent of the Second World War when the park again went into decline. In the 1960s and 70s it was a favorite gathering place for New York City's drug dealers. In 1980, the Rockefeller brothers initiated another restoration by founding the Bryant Park Restoration Corporation (BPRC).

D. Biederman, innovator and president of the Bryan Park Management Corporation (BPMC), initiated an experiment with the aim of bringing visitors back to the park and generating revenue

for continued park management. The park was closed for renovation from 1988 to 1992. When it re-opened, it had become a beautiful and vibrant public space which could offer visitors a variety of activities year round. In 1996, the park was awarded the Urban Land Institute Excellence Award for Public Projects (Biederman, n.d.). Bryant Park now boasts a public outdoor cinema, a venue for concerts, concession kiosks, and restaurants, and in winter an ice rink and a winter village. The park is equipped with moveable chairs that allow visitors a sense of control over their recreational experience. Even the open-air reading room has been resurrected. All this has led to a 92% reduction in crime, and the number of visitors per year has doubled.

This successful implementation of the arrangement of the park and the creation of an open urban public space was met with an overwhelmingly positive response from the local community. As in other areas it has brought about ever-increasing property values (Morris, 2015).

10. List of characteristics to be monitored and expected indicators with impact on sustainable development

The list of sites examined in the case studies:

- 1 Brno – Vinohrady, Palavske Square
- 2 Brno – Vinohrady, area in front of commercial facilities
- 3 Brno – Vinohrady, open area between high-rise buildings
- 4 Brno – Vinohrady, open area – inner courtyard
- 5 Brno – Lesna, open space between two prefabricated high-rise apartment houses
- 6 Graz, Tannhof I
- 7 Graz, Tannhof II
- 8 New York, residential segment of the High Line
- 9 New York, Bryant Park

Urban open space is significantly affected by its functional context. For prefabricated housing estates, the dominant urban function is residential. Localities 1 and 2 in Brno – Vinohrady are a minor exception. Palavske Square (Locality 1) attempts to fulfill the function of a public space – act as a meeting place, a place for recreation and various other activities. While localized services and supplementary commercial facilities do exist, detailed examination is not necessary to determine that the square has failed to fill its primary function. Aside from the problematic appearance of the space itself, there is also the negative influence of an unfortunate transportation solution. The entire square functions as a traffic circle. This both complicates access and makes the square an uncomfortable place to linger. Locality 2, though smaller, does a better job of acting as a public space. It is situated at the crossroads of important pedestrian traffic routes (connecting the public transportation stops with the housing estate) and near the entrance to commercial facilities, which are used by the entire housing estate (a grocery store, a drug store, a flower shop and a bank). This area hosts a number of activities throughout the year, various kinds of open-air markets, wine festivals, and so on.

Localities 3–5 are purely residential in character. The parterre of the apartment buildings is practically cut off from public spaces and serves merely as a point of entry to individual buildings. This basic, common characteristic is labeled “interaction,” and in this case it is possible to define it as “small.”

Localities 6 through 9 will be examined in detail in the period from September 2015 to June 2016.

After a complete list of sustainability indicators has been formulated, we will be able to evaluate their respective impact for each of the cases studied. This influence will then be analyzed and confirmed by means of observations of open spaces within a specific period of time. Next, data measurements taken from the open spaces under consideration will be reviewed and relevant comparisons of data will be made. Finally, influence will be evaluated through questionnaires to be completed by residents/users of the adjacent buildings. Using the results that have been obtained, it will then be possible to identify those characteristics of open space that affect sustainability indicators and thereby enhance or degrade the potential for sustainable urban development.

Examples of expected indicators and additional parameters are listed below (Table 1).

Table 1. Expected indicators of sustainable development of open spaces

Framework indicators and additional parameters	Lead variables
Social Indicators To be obtained by observation and from statistical data	Intensity of attendance, predominant use of space, demographic diversity, problems, In the Czech and Slovak Republics, data from census of houses and apartments, abroad data obtained from registers
Economic Indicators To be obtained from statistical data	Obtained from the cadastre, by findings and observations, average price of property, average rental rates, type of ownership, operation costs
Environmental Indicators To be obtained from passports, aerial photographs, measurements, and observations	Ecological value (increase of ecological stability, occurrence of problematic plants, increased retention of rainwater), well-being of citizens (reduction in summer temperature peaks, increased air humidity, reduced sunstroke in summer, limited insolation apart from summer, wind reduction, control of dust and chemical pollutants, natural fragrance, limited noise pollution, pleasant natural sounds, optical isolation from street activity, attractiveness, security risks), bodies of water

11. Conclusion

Both identical characteristics and differences are already apparent from the analysis of the urban characteristics of the two prefab housing estates and their sub-sites in Brno. One of the crucial differences would seem to be the unique urban concept of the site Brno – Lesna, which is assumed to provide considerable potential for the development of the environmental pillar of sustainable development. The support for the other two pillars will evidently be similarly unbalanced and questionable, as in the case of the site Brno – Vinohrady. These are all assumptions, however, which will have to be confirmed by further research. Relevant conclusions will be drawn after a thorough analysis of data gathered at target sites (during the period from September 2015 to June 2016) has been completed.

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