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A case of Economic and Technical Development Zone, China

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Green Approach for Post-industrial Urban Regeneration: A case of Economic and Technical Development Zone, China

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Abstract. For cities facing post-industrial transition, urban greenways are proven strategies to activate urban spaces and improve the sustainability of cities. However, significant challenges remain when seeking to link greenways as a greenway network and integrate greenway networks to urban spaces. Given this shortcoming, Yantai National Economic and Technical Development Zone (YEDZ) was selected as a representative case. This paper analyzed the potential role of greenway network and requirements of post-industrial development for the urban environment. It seeks to develop a regeneration approach that integrating urban greenway planning with overall urban reform. Our priorities are providing a pedestrian network with non-utilitarian rhythms by activating former industrial spaces, restructuring urban green spaces, and integrating greenway networks into diverse urban spaces. In this way, it reveals the comprehensive benefits of the urban greenway network and improves overall urban form - multiple benefits, including economic development and social rewards, be created in the regeneration.

1. Introduction

Greenways have always been seen as essential spaces with ecological, leisure, and aesthetic values [1]. Greenway planning is closely related to sustainable development in various aspects [2,3,4]. Large scale ecological greenways often link urban and suburban areas within one city or in several cities at a regional scale. Within urban spaces or metropolitan areas, the multiple functions of an urban greenway would largely contribute to building sustainable cities and communities by providing pedestrian-friendly network and green open spaces, which are more beneficial rather than a single ecological corridor. The urban greenway planning requires comprehensive consideration on the urban environment. Based on land use trends and landscape planning, Ahern proposed four modes for greenway planning strategies: protective, defensive, offensive, and opportunistic [5]. However, the development of a greenway planning approach that reflects diverse urban environments requires further exploration.

National Economic and Technical Development Zones (EDZs) began being strategically established for economic development in China after the reform in the 1980s [6]. The early development of EDZs primarily relied on the manufacturing industry. Therefore, mass transportation networks and un-human scale blocks with heavy industry clusters were built. However, with decades of urbanization and development, many EDZs in China are seeking new development opportunities in the post-industrial period. The existing urban spaces cannot fulfill the requirements of the future.

The urban form of the early development stage of EDZs are demonstrated as typical examples in industrial cities that have massive vehicle transportation systems. To deal with spatial issues of industrial cities, Lynch used an open space network model to create an interactive open space system that broke up the former spatial structure [7]. It emphasized a parallel loose rhythm network with pedestrian and cycling experiences, rather than high-speed commercial or vehicle transportation areas. This organic open space system broke up the existing solid urban structure and mobilized urban life with diversity and new development opportunities. The open space network presented an opportunity for people to exit from the endless accumulations in a metropolis [8]. It offered an alternative environment where people could stay away from high-speed vehicle transportation and the life rhythms of the industrial city urban environment.

In this study, a regeneration approach is explored to introduce greenway planning as a part of comprehensive urban reform. It seeks to enhance the accessibility of green open space and transform traditional industrial urban areas into a pedestrian-friendly city area with a loose rhythm of life which may further lead to sustainable cities and communities. This study uses a representative urban area with manufacturing features, the Yantai EDZ, which is now facing de-industrialization transition and urban regeneration, as a case study. Issues of existing green spaces and how greenway networks could contribute to post-industrial development have been discussed in this research. Essential urban spaces, including cultural-creative clusters, commercial centers, and community centers, are organically distributed and integrated with a greenway network - this approach responds to both Ahern and Lynch's work. With a human-scale pedestrian system, the urban form is also changed. Using these ideas, this proposal seeks to mobilize low-efficiency land and create opportunities for further development in the post-industrial period by creating a high-quality built environment.

2. The greenway network in post-industrial urban regeneration

2.1. Greenway

A greenway is linear open space established along either a natural corridor, such as a riverfront, stream valley, or ridgeline or overland along a canal, a scenic road, or a disused railway line [9]. The greenway, the "Emerald Necklace" in Boston designed in the 19th century by Frederick Law Olmsted, is an original and classical sample. It links the main green spaces within the city, provides public open spaces, and also connects each part of the city with a pedestrian or cycling system. It brings vitality and attractiveness to the entire city.

Based on the objectives of greenway construction, Searns divided the development process of greenways into three generations. From the 18th century to the 1960s, greenways included axes, boulevards, and parkways. Generation two lasted from the 1960s to the mid-1980s, and typical greenways were comprised of former abandoned railways and previous urban creeks and rivers, and they were famous areas for rail-to-trail movement. Based on this, the third generation lasted from the mid-1980s to the mid-1990s and featured 'multi-objective greenways' with recreational and educational effects and traditional ecological benefits [10]. Extended from Searns's definitions, Karl identified the fourth generation from the mid-1990s to the present. This generation views greenways as 'integrated

green infrastructure' that emphasizes the regeneration of the grey infrastructure into a valuable urban fabric [11]. This means that greenways and the urban pattern are viewed "as a whole."

Greenway planning is a relatively new and growing concept in China. The greenway movement in China began in the late 1990s. Many planning approaches have focused on the ecological perspective, including geographical techniques and security patterns [12,13]. Recent greenway planning seeks to integrate multiple needs and maximize benefits for all users and society as a whole [14,15].

2.2. Greenway network

A greenway is closely related to the urban fabric and form as a network. The layout of a greenway network can make a difference at both the district and regional scales simultaneously [16]. Rather than a greenway shaped in a single line or circle, a greenway network provides a comprehensive opportunity for urban functions in the post-industrial period. Fabos emphasized the greenway as a network, and the widths of a greenway can be various [17,18]. Strang also expressed that existing infrastructure systems can capture the potential to shape the urban form [19]. Because they are integrated with the urban infrastructure and overall urban environment, a greenway network also makes a difference in the urban form. In addition to their influence on the urban form, a greenway network also influences the urban experience. Vehicle transportation systems determine the route of residents in their everyday life due to their consistent high speed. However, a greenway network with an unclear edge and open organic forms can balance certainty and exploration [11], which means a new urban rhythm. Compared with a vehicle network, a greenway network is an attractive aspect of urban life, rather just than a pipeline.

2.3. Greenway networks in Post-industrial urban regeneration

Greenway networks provide green spaces in diverse sizes and shapes, and in post-industrial cities, green spaces can provide not only ecological benefits but unique social and economic meaning.

Post-industrial urban regeneration mostly means a transition from manufacturing industries to urban service, cultural industries, and creative industries. Green spaces can also contribute to economic growth. It has been demonstrated that investment in green spaces results in apparent increases in the third industry rather than in manufacturing industries [20]. This phenomenon is possible because urban service industries require high-efficiency information communications. In terms of urban planning and design, this result probably requires an organic planning approach to ensure a mixed space that encourages people to gather, rather than stay in isolated spaces and functions.

Besides, creative industries and so-called creative classes are primary drivers of economic growth in post-industrial cities. Compared with the traditional working class, the creative class pays more attention to the quality of space [21,22]. In particular, the creative class in China has a strong preference for landscape amenities, like parks and urban gardens, rather than nightlife streets and bars [23]. High-quality urban green spaces that organically mix with urban functions, such as office buildings, may result in a successful economic transition.

The cultural and social role of greenway networks in the post-industrial period also makes a difference. As industrial cities have some common issues, such as massive scale and huge blocks, they can lack human consideration and cultural values. The split between the form and function of infrastructure can be viewed as utilitarian, and it has no civic value like collective memory and cultural function [24]. A greenway network is a parallel system compared with the vehicle transportation infrastructure that can activate personal emotion into a local space [25]. A greenway network provides multiple functions with cultural and social values and the quality of urban spaces increase [26]. In this way, the potential for the post-industrial development of commercial services, entertainment, and tourism may be revealed.

3. Urban regeneration in the Yantai EDZ, Shandong

3.1. Introduction of the Yantai EDZ

The Yantai EDZ is located in Yantai, Shandong Province, facing the Bohai Sea on the north coast [Figure 1]. The East YEDZ is the original portion, and it has a total area of approximately 36 square kilometers [27]. With continuous development and urbanization in recent years, a large number of low-efficiency industrial land has been merged in the YEDZ. Along with the transition development strategy of the Bohai Sea Big Bay Area and the City Planning of Yantai City (2018), the Yantai Municipality decided to move the manufacturing industries to the west district of the YEDZ. The regeneration project was set to begin in the East YEDZ as the Management of YEDZ request when they seek academic consultancy support from our group.

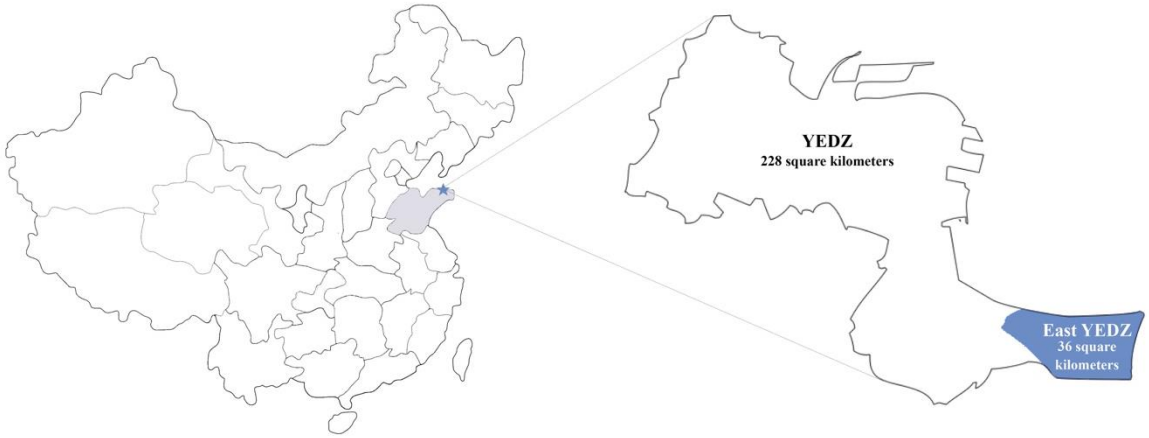

Figure 1. The location of YEDZ.

3.2. Main issues of existing urban form in Yantai EDZ

An analysis of current urban spaces was conducted from both urban structure and green space aspects. In terms of the overall urban form, it was found that the primary issue is the large-scale blocks and the vehicle transportation network [Figure 2]. It is an example that modern traffic engineering with its up-scale lane dimensions has bloated into a mega-boulevard, which is so common in China [28]. The massive scale issue has also influenced current green spaces. The connections between each green space are inferior, and they are isolated from each other and separated from the urban space by 4-6 lanes roads. These green spaces are either located at the edge of the urban areas or isolated from urban spaces. They lack connections with the urban function and are not convenient for citizens to use. The distribution and form also limit the multiple functions of green spaces.

Figure 2. Left: The existing street network. Right: The existing green spaces.

4. Greenway network planning and urban regeneration in the East YEDZ

Due to the requirements of further sustainable development in the post-industrial period, a regeneration approach that combines greenway network planning and overall urban reform has been conducted by utilizing several necessary actions.

4.1. Low-efficiency industrial land provides opportunity for greenway network construction

In cities that have no abandoned infrastructure, the opportunity for interweaving a green network into the urban fabric typically presents an impasse [11]. Based on the land use preparation, existing enterprise investigations, and fieldwork with cooperation of local municipality, 10 km^2 of available land have been prepared for urban regeneration [Figure 3]. Based on the land use catalog, most of these areas are industrial lands that have factories, and these will be moved to the west YEDZ. A small portion is commercial, residential, and green land. From the distribution of available land, there is a belt between Zhujiang Road and Jinshajiang Road that is located in the central area of the East YEDZ. These 10 km^2 of land provide an opportunity for post-industrial urban regeneration in the East YEDZ.

Multiple regeneration methods will be applied within these available lands, including both demolitions and soft spatial adjustments. New urban spaces at the human scale have been introduced into the central East YEDZ. A multi-functional greenway has been introduced into this former industrial belt, along with several core urban functional areas. This belt links essential areas, such as the commercial center and cultural-creative clusters. With this link, people can move between inner city and coastal area by walking comfortably. It also links existing green spaces, such as the Coastal Forest and the Fulai Mountain Park. Along with the central green belt, a greenway network has been generated. This greenway planning in the east EDZ seeks to mobilize the current low industrial structures into a vibrant urban area. It is a combination of a third- and fourth-generation greenway.

4.2. Generation of greenway network

The greenway network proposal has three types of green spaces based on the regeneration action: kept green spaces, regenerated green spaces, and new built green spaces [Figure 3]. The breakdown of the previous order and the establishment of these new heterogeneous relationships need to be regarded as vital background when reinterpreting the almost abandoned spaces as part of the green structure [29]. Most of the large scale important ecological green spaces have been kept to ensure the overall urban ecological capacity, for example, the Coastal Forest and the Jia River Waterfront [Figure 2]. The regenerated green space means a new site design and the introduction of new functions of existing green spaces. New green spaces are located within 10 km^2 of available land. They are linear greenways with urban gardens, community parks, or urban plazas that are integrated with multiple urban functions. A majority of the new green spaces are not vast in scale, but they serve as links of each part of the urban area. The distribution of new green spaces allows for the integration and response to new urban functions like cultural-creative studios, loft apartments, community cultural centers. Three types of green spaces constitute the overall urban greenway network.

Figure 3. Left: The available land. Right: Types of green spaces based on regeneration methods, and available land.

4.3. Breaking the existing urban pattern

The new greenway network introduces a small-scale pedestrian system into the existing mass blocks. This new urban pattern breaks up the former large transportation network. It provides a possible new lifestyle for residents with a pedestrian-friendly experience. The construction of green space changes the vehicle dominant lifestyle and habitats of residents [30]. This new network seeks to offer a continuous soft urban interface for residents. Within many blocks, the way the new greenway network interacts with the existing street network has strategically been made different from the former pattern. Where the greenway cuts through a large-scale block, it may increase opportunities for exploring and adventurous experiences.

4.4. Greenway network and urban form

Only when multiple urban functions are integrated can the potential benefits of a greenway network be revealed. The greenway network of the East YEDZ is not only a self-centered spatial system, but also links essential commercial, cultural, and educational spaces in this urban area [Figure 4]. The integration of green space and urban functional spaces is a vital approach to regenerate urban areas. When a greenway meets a commercial space, an outdoor commercial artistic plaza becomes part of the greenway. When greenways cross into residential communities, they provide public leisure facilities and community parks for residents. The linear shape of greenway also leads people to enter the cultural-creative clusters. The way how the greenway network combined with urban blocks is based on a discipline that encourages interactions between green spaces and other urban spaces.

Figure 4. Left: The greenway network and vital urban functional areas. Right: The multiple layers of urban pattern.

5. Conclusions

The greenway planning integrated with urban reform is a strategy to meet diverse requirements and ensure sustainable cities. The Yantai EDZ experience of greenway planning and urban regeneration can serve as a model for other cities facing post-industrial transitions. The introduction of a human-scale greenway network into an existing vehicle transportation system will enhance urban spaces' quality. An integrated urban environment with high-quality spaces also seeks to attract creative classes and tourists, which are crucial activators of post-industrial economic development.

The regeneration of urban forms attempts to incorporate both issues related to the quality of urban experiences and new economic development opportunities. However, the shortage of efficiently re-developable spaces may limit the generation of greenway network. As many built areas are private-

owned and with little flexible spaces for improving the quality of built environment, it may sustain the utilitarian urban form. The integration of greenway and public urban functions need to be considered in diverse scales and types within a specific local context. Small scale urban spaces like alleyways, pocket parks and street sidewalk could not be ignored while they are essential spaces in stimulating social lives. The greenway network generation may not be only at ground level but could also include elevated green spaces. For example, the podium open space is an integral part of green spaces in Hong Kong. Compared with state-led regeneration, applying the planning strategy discussed in this paper requires more modifications and adjustments in varied partnership models. Future projects may consider more public participation to identify potential desirable green spaces.

Greenways with multi-functional capacity have great potential for the promotion of post-industrial urban transitions. Several urban issues related to sustainable cities have been addressed. In the future, if the local municipal intends to improve the accessibility of the green space, they may consider integrating greenway network with overall land use, such as public cultural building, commercial center, and creative-cultural cluster. For cities that have isolated and separated green spaces, the planners could seek opportunities to mobilize the reconstruction of existing green spaces into a greenway network. The secure integration and connection of greenways to a wide variety of urban environments, allow for further opportunities to improve the greenway network concept. Concerning open space, an urban greenway is not only capable as an ecological corridor, but it can provide increasing social interaction opportunities. It services to achieve greater public accessibility within inner urban areas that may contribute to sustainable cities' vitality and attractiveness.

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7. References

[1] Linehan J, Gross M, Finn J. Greenway Planning - Developing a Landscape Ecological Network Approach. *Landscape Urban Plan*. 1995;**33**(1-3):179-93.
[2] Miller W, Collins MG, Steiner FR, Cook E. An approach for greenway suitability analysis. *Landscape Urban Plan*. 1998;**42**(2-4):91-105.
[3] Xiang WN, Stuber RMB, Meng XC. Meeting critical challenges and striving for urban sustainability in China. *Landscape Urban Plan*. 2011;**100**(4):418-20.
[4] Conine A, Xiang WN, Young J, Whitley D. Planning for multi-purpose greenways in Concord, North Carolina. *Landscape Urban Plan*. 2004;**68**(2-3):271-87.
[5] Ahern J. Greenways as a Planning Strategy. *Landscape Urban Plan*. 1995;**33**(1-3):131-55.
[6] Liu Z, Geng Y, Zhang P, Dong HJ, Liu ZX. Emergy-based comparative analysis on industrial clusters: economic and technological development zone of Shenyang area, China. *Environ Sci Pollut R*. 2014;**21**(17):10243-53.
[7] Lynch K. Good City Form. Cambridge. Mass.(3nd ed.),, MIT Press; 1981.
[8] Jameson F. *Postmodernism, or, the cultural logic of late capitalism*: duke university Press; 1991.
[9] Little C. Greenways for America, 1990. *Baltimore and London: The Johns Hopkins 288p*.
[10] Searns RM. The Evolution of Greenways as an Adaptive Urban Landscape Form. *Landscape Urban Plan*. 1995;**33**(1-3):65-80.
[11] Kullmann K. Green-networks: integrating alternative circulation systems into post-industrial cities. *Journal of Urban Design*. 2013;**18**(1):36-58.

[12] Yu K. Security patterns and surface model in landscape ecological planning. *Landscape Urban Plan*. 1996;**36**(1):1-17.
[13] Yu K. Landscape ecological security patterns in biological conservation. *Acta Ecologica Sinica*. 1999;**19**(1):8-15.
[14] Teng MJ, Wu CG, Zhou ZX, Lord E, Zheng ZM. Multipurpose greenway planning for changing cities: A framework integrating priorities and a least-cost path model. *Landscape Urban Plan*. 2011;**103**(1):1-14.
[15] Liu K, Siu KWM, Gong XY, Gao Y, Lu D. Where do networks really work? The effects of the Shenzhen greenway network on supporting physical activities. *Landscape Urban Plan*. 2016;**152**:49-58.
[16] Whyte WH. The Last Landscape. 1968. *Philadelphia: University of Pennsylvania*. 2002.
[17] Fabos JG. Introduction and Overview - the Greenway Movement, Uses and Potentials of Greenways. *Landscape Urban Plan.* 1995;**33**(1-3):1-13.
[18] Tan KW. A greenway network for Singapore. *Landscape Urban Plan*. 2006;**76**(1-4):45-66.
[19] Strang GL. Infrastructure as landscape [infrastructure as landscape, landscape as infrastructure]. *Places*. 1996;**10**(3).
[20] Zhao L, Chen WZ. Estimating urban green space production in the macroeconomy: From public goods to a profitable method of investment. *Urban Forestry & Urban Greening*. 2018;**33**:16-26.
[21] Florida R. The rise of the creative class. *Reg Sci Urban Econ*. 2005;**35**(5):593-6.
[22] Yung EH, Chan EH, Xu Y. Community-initiated adaptive reuse of historic buildings and sustainable development in the inner city of Shanghai. *Journal of Urban Planning and Development*. 2014;**140**(3):05014003.
[23] He JL, Huang XJ, Xi GL. Urban amenities for creativity: An analysis of location drivers for photography studios in Nanjing, China. *Cities*. 2018;**74**:310-9.
[24] Morrish W, Brown C. Putting Place Back into Infrastructure. *Landscape Archit*. 1995;**85**(6):50-3.
[25] Massumi B. Sensing the virtual, building the insensible. *Archit Design*. 1998(133):16-25.
[26] Jian IY, Luo J, Chan EH. Spatial justice in public open space planning: Accessibility and inclusivity. *Habitat International*. 2020:102122.
[27] Tian QB, editor Forecast of Urban Public Transport Demand in Yantai Economic and Technological Development Zone. Applied Mechanics and Materials; 2014: Trans Tech Publ.
[28] Jacobs AB, Macdonald E, Rofé Y. *The boulevard book: History, evolution, design of multiway boulevards*: Mit Press; 2002.
[29] Qviström M. Network ruins and green structure development: An attempt to trace relational spaces of a railway ruin. *Landscape Research*. 2012;**37**(3):257-75.
[30] Palazzo AL. The Boston Greenway: Form and Process Issues at Stake. *Journal of Urban Design*. 2014;**19**(3):352-67.