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The Planning and Optimization Strategies for Urban Non-Mobilized Traffic System - A Case Study in Tianjin, China

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ABSTRACT
In the era of accelerating green development, this study focuses on the development of non-mobilized traffic system in large cities. By reviewing the international experience and development trend of green transportation and environment-friendly design, the paper summarizes the optimization strategies for the dynamic non-mobilized system through a case study in the city of Tianjin, China. Tangible plans are made for a new and innovative non-mobilized traffic system in the city, with an emphasis on the improvement of the public space environment and the interplay with the advanced urban transportation systems. Positive effects of the action plan come from the enhanced connectivity, optimized service, and connected living areas, which can provide more useful reference and guidance for the optimization of future urban environment.

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I. INTRODUCTION

In the era where motorized transportation used to dominate, spaces for non-mobilized uses have been significantly reduced, leaving behind numerous shortcomings in urban construction. Many scholars have pointed out issues such as the deterioration of transport environments as well as the decrease in the proportion of non-mobilized transportation in mega-cities. Participants who rely on non-mobilized system may even be considered as vulnerable groups in the whole transportation system. Following the worldwide agreed sustainable development goal, building city's necessary non-mobilized traffic system has become an important element for urban transportation infrastructure. The non-mobilized traffic system that often contain large greenway networks and well-connected pedestrian pathways, provides convenient, safe, and comfortable spaces for cycling and walking. It also plays a critical role for connecting interesting areas and livable communities inside a large city.

II. LITERATURE REVIEW

Concerns about climate change, air pollution, and public health, Jan Gehl (1971) proposed that urban public spaces should have a close relationship with urban public transportation and urban non-mobilized traffic. The bicycle traffic in Copenhagen, Denmark, is regarded as a model of the urban non-mobilized traffic system. The city's well-developed non-mobilized traffic system enables more than 60% of residents to use bicycles as their primary means of transportation, with a total daily cycling distance of up to 1.44 million kilometers. Recently, New York city has successively introduced public street design guidelines, returning bicycles to the city to further alleviate urban traffic congestion caused by motor vehicles. Under the backdrop of green urbanization, Beijing aims to built its first bicycle-only road to reach a bicycle lane mileage of about 2300 kilometers by 2035, encouraging residents to travel green. Shanghai introduced the Street Design Guidelines, adhering to the people-oriented principle, shaping urban streets into safe, green, vibrant, and smart high-quality public spaces, and reviving street life. The non-mobilized traffic system aims to improve the construction of slow-speed travel,

carry out humanized and refined road space and traffic design, and build a safe, continuous, and comfortable urban slow-speed travel system (Wolch, 2010). The construction of the urban non-mobilized traffic system is imminent, and it is necessary to provide urban residents with convenient, vibrant, and colorful slow-speed travel experiences. Furthermore, the system is not simply the simple combination of pedestrian paths, bike lanes, and traffic lights, but rather a comprehensive interaction and connection between various material elements related to slow-speed travel behavior and activities.

Non-mobilized traffic can bring a range of environmental, economic, and social benefits (Tang, 2020; Pinna, 2021). Advocating for green transportation can help reduce greenhouse gas emissions and air pollutants, decrease the demand for fossil fuels, and alleviate traffic congestion while improving road safety (Garcia, 2020). For instance, connecting with nature conservation can help enhance biodiversity (Tzortzi, 2020). Promoting physical activity can contribute to improving public health and fostering a green commuting and lifestyle (Zhang, 2022). By upgrading the aforementioned systems and making cities more livable and attractive places to live and work, more sustainable and livable public resources can be created for residents (Pinna, 2021).

III. A CASE STUDY IN TIANJIN ECONOMIC-TECHNOLOGICAL DEVELOPMENT AREA

The Case Study Area of Tianjin City

Tianjin has become one of the top largest cities in China since the early 20th century. Located just 70 kilometers from the capital city Beijing, Tianjin is one municipality under the direct lead of the Central Government. It is a key area of China's heavy industry and export base, adjacent to the large Tianjin port and vast coastal areas. The proposal of Tianjin new plan generated under the great constraints of limited urban land recourse, largely accumulated urban population and high urban density. Thus, transformation planning and innovative governance are indispensable for exploring a sustainable pathway for the city's future. The well-being of local citizens has been great emphasized as the core pursuit of future's urban development, representing a more sustainable orientation for future development.

The Current Non-Mobilized Traffic System

The Tianjin Economic-Technological Development Area (TEDA) has been established for more than thirty years. The area focuses on industrial development, utilization of foreign capital and export to create foreign exchange, and is committed to developing high-tech industries. The TEDA was initially positioned as an industrial park, with city roads mainly serving as logistics channels and rapid main roads for heavy traffic, lacking humanized non-mobilized traffic spaces. With continuous development and changes in urban functions, the TEDA has been gradually transformed from a traditional industrial park into a core area of the coastal city Tianjin, and needs to further improve urban supporting service functions and the construction of an integrated urban transportation system on this basis. The 2035 Vision for TEDA points out that the area needs to build a modern integrated transportation network and accelerate the construction of non-mobilized traffic networks to enhance local economic and social development. The central business area of TEDA is a key development battlefield, mainly focusing on financial and business offices. Therefore, the non-mobilized traffic space system is relatively well-developed, with excellent non-mobilized traffic quality and accessibility. However, the non-mobilized traffic system in most other areas of the TEDA is not well developed, lacking systematic planning, with outdated facilities and extremely poor connectivity, and urgently needs improvement.

Problems in the Current Transportation System

- City non-mobilized traffic roads are not connected, and it is difficult to cross streets across regions

Urban transit traffic and urban railways cause area fragmentation, making it difficult to cross streets across regions. Most city roads lack non-mobilized traffic crossings; industrial areas generally have too long cross-street paths, it is difficult to cross the street with a single red and green light, and there is no safe island for crossing the street; the traffic on the main roads is large and fast, without non-mobilized traffic protection measures, and pedestrians feel unsafe when crossing the street.

- Urban non-mobilized traffic facilities need to be improved, and the overall quality is poor

The non-mobilized traffic facilities of the existing road system are not complete, and it is necessary to check for omissions and improve the quality of non-mobilized traffic space. Some non-mobilized traffic lanes in the area are cut off by motor vehicle lanes, and the pavement of non-mobilized traffic lanes is seriously damaged; the barrier-free non-mobilized traffic design such as blind roads and downhill sidewalks on most non-mobilized traffic lanes needs to be improved; parking chaos in front of public and commercial facilities severely occupy

non-mobilized traffic lanes; the city image recognition system is not complete, and the non-mobilized traffic experience is not good.

- The combination of urban non-mobilized traffic lanes and greenways is poor, and the usage rate is low

The existing greenways in the city are mainly concentrated around the city's main roads and expressways, with rich vegetation in the greenways. However, the connection between the city's greenways and non-mobilized traffic lanes is not high. Within the non-mobilized traffic lanes, supporting facilities in the greenways are missing, resulting in a low usage rate of greenways. Furthermore, there is a lack of connection between greenways and non-mobilized traffic lanes, the overall connectivity is weak, making it difficult to form a complete network. As the overage of public green spaces is not high, the public interest and comprehensive functions in the greenways are also lacking.

IV. THE NEW PLANNING STRATEGIES FOR IMPROVING URBAN NON-MOBILIZED TRAFFIC SYSTEM

Survey Methods

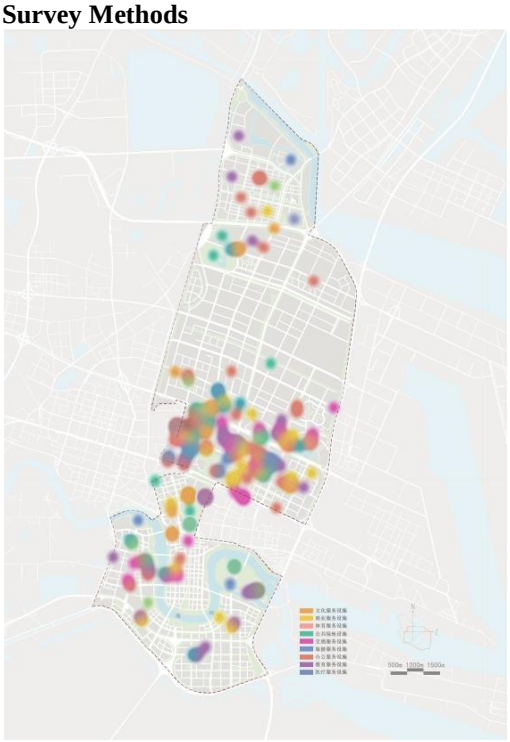

Figure.1 The heat map for interest points

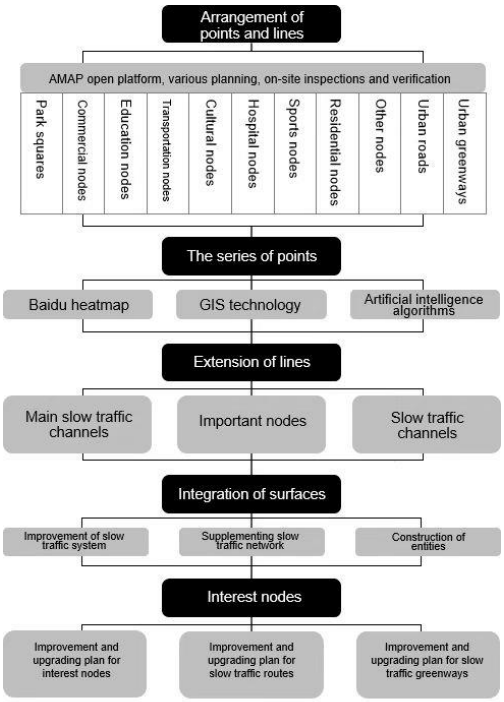

Figure.2 The technique route

A public environment evaluation is used to extract environmental evaluation elements and quality ranges, and to define the research objects for the public space nodes, important functional service facility nodes, and existing non-mobilized traffic roads in Tianjin Economic-Technological Development Area. Combined with past research results and expert opinions, the vitality factors for the non-mobilized traffic system in the TEDA were determined. These factors include: public space node type, service range of functional facilities, connectivity of non-mobilized traffic roads, isolation of non-mobilized traffic from motor lanes, plant richness of non-mobilized traffic lanes, non-encroachment of non-mobilized traffic lanes, quality of non-mobilized traffic facilities, barrier-free facilities for non-mobilized traffic, adding children's exclusive signs on non-mobilized traffic lanes, exclusive non-mobilized traffic lanes for children, connection of non-mobilized traffic lanes with school entrances and exits, combination of non-mobilized traffic lanes and greenways, interesting spaces of non-mobilized traffic lanes, and links between non-mobilized traffic lanes and public transport facilities. This step provides support for the next step of planning strategy with in-depth spatial analysis and data integration.

Planning the New Urban Non-mobilized Traffic System

- Points Linkage

This method forms a map of interest and functional nodes. To Integrate and analyze the current situation of important nodes with large pedestrian flow, the new plan for the urban non-mobilized traffic system aims to improve the frequency of the network, and complete functional facilities within the TEDA, including 29 cultural facility nodes, 28 commercial nodes, 11 sports facility nodes, 14 hospital facility nodes, 20 public transportation nodes, 20 educational facility nodes, and more than 40 office facility nodes, etc. They are sorted by different elements, combined with big data to analyze user behavior, and realize the linking of points.

- Lines Extension

This method aims to break through traffic bottlenecks and creating a comprehensive non-mobilized system for the current 58 non-mobilized traffic roads. It integrates the important nodes of non-mobilized traffic ends and bottlenecks, overlays multi-factor smart planning, and carries out low-cost micro-transformations. The application will increase non-mobilized traffic crossing facilities, improve non-mobilized traffic intersections, enhance the quality of non-mobilized traffic channels, and realize the connection of non-mobilized traffic channels.

- Surface Integration

This method aims to define the key areas where non-mobilized traffic is prioritized and create a functional grading, clear hierarchy, and continuous urban greenway and non-mobilized traffic system network as the basic carrier for city quality upgrade, providing a basis for zoning classification and management.

- System Construction

This method aims to build a community integrating space and people, which need to combine ground traffic, underground traffic, and above-ground traffic into a whole body (Figure 3). The plan also requires the transformation and enhancement of interest nodes and routes, plan various urban activities related to non-mobilized traffic, enhance the sense of belonging and cohesion of urban residents. This will also transform daily commuters into non-mobilized system users. Their green travel in public transportation will optimize the local industrial environment, enhance the value of marginal land, and improve urban vitality.

The Connection With the Large Urban Transportation Systems

The work aims to strengthen the connection between the non-mobilized traffic system and the public transportation system, improve the directness and safety of the non-mobilized traffic lane to subway stations, functional facility nodes, open spaces and other facility nodes. Increase the main road crossing paths, optimize the non-mobilized traffic crossing facilities: taking the example of the Taida Avenue Expressway, add non-mobilized traffic crossing channels at the intersections of Dongting Road and Beihai Road with Taida Avenue; add non-motor vehicle crossing facilities at Huanghai Road, Nanhai Road and Taida Avenue, using color paving to clarify road rights, set up crossing safety islands, separate non-mobilized traffic from motor lanes, improve the overall non-mobilized traffic accessibility and non-mobilized traffic environment quality.

Upgrade the regional traffic's non-mobilized traffic pedestrian bridge facilities, and upgrade the existing transit pedestrian bridges: upgrade the cross north-south connection pedestrian bridge at the Civic Square, add convenient non-motorized up and down bridge passages, divide separate slow walking paths; add independent non-motorized lanes to the pedestrian bridge crossing the Financial Plaza, Taihu Road and Taida Avenue, add gentle slope entrances and exits. Build a new non-mobilized traffic pedestrian bridge from Xingang 4th Road to Central Avenue, strengthen the connection with the Cultural Center area, strengthen the accessibility, convenience and safety of non-mobilized traffic, and expand the commercial functions and park green space resources around the Cultural Center.

The Construction of A Urban Vitality Ring

Relying on the existing non-mobilized traffic network in TEDA, combined with the heat distribution of public environmental impact evaluation factors, sort out public spaces and functional nodes according to travel destinations, consider a travel radius of five to fifteen minutes walking distance, and link various functional facility nodes to build a non-mobilized traffic vitality ring (Figure 4). Relying on the good basic elements of the existing non-mobilized traffic road layout (clear road rights, good basic road facilities, concentrated functional facility nodes, dense human activities), link the non-mobilized traffic vitality ring into a network, and link each vitality ring area. Combine the surrounding functional activity facilities to improve the efficiency of the vitality ring. According to different functional facility nodes, carry out different planning content, and construct a themed, vibrant, and atmospheric non-mobilized traffic quality space. The action plan finally has created five major theme city living rooms in Tianjin Development Area, improve the spatial quality of the walking ring, provide residents with the best urban non-mobilized traffic landscape, and enrich urban service functions.

- Cultural Center Area Development Action: Plan a non-mobilized traffic path to connect the Cultural Center, Wanda Plaza and Ziyun Park; transform the existing ground parking into three-dimensional parking to improve space utilization efficiency; design outdoor shared squares and shared viewing lawns for large-scale commercial activities and city cultural activities, strengthen the connection with the existing square and Ziyun Park slope

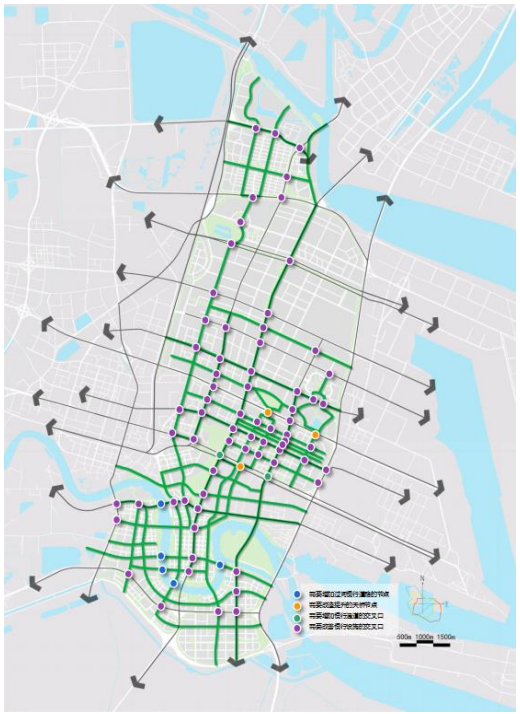

Figure.3 Plan for the non-motorized system in TEDA

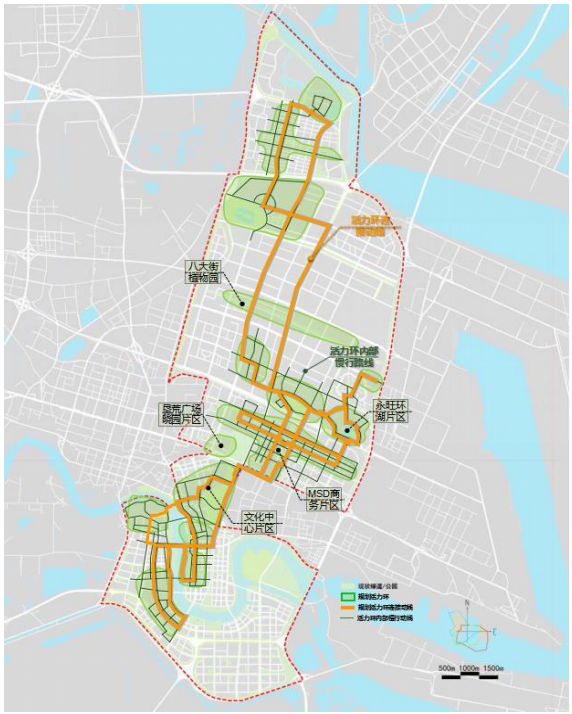

Figure.4 Non-mobilized traffic Vitality Ring Action Plan

green land.

- Yongwang Lake Area Development Action: Create a water-friendly landscape platform along the lake, design water-friendly steps, walkways and viewing platforms, open up the slow walking path around the lake, and connect the Yongwang commercial complex, TEDA football field, TEDA fashion square and convention and exhibition center stations into a ring. Through the Taida Avenue overpass to introduce community residents in the southern area, enhance the fun, interactive, community vitality of the space, and create a one-stop slow leisure and entertainment experience.
- MSD Commercial Area Development Action: Improve the vitality of the cross-axis space atmosphere by improving the relationship between people and vehicles; connect city parks with green belt, Binhai Isetan, Hongtai Commercial District, Chow Tai Fook Financial Center, MSD Business District, Financial Street Business District, TEDA Hospital and Nankai Binhai College along the non-mobilized traffic route in the district, activate the property value of each functional space; shape the core urban landscape and public space anchor point of Tianjin Economic-Technological Development Area, create a multi-functional, all-round interactive space that

integrates business office, leisure and entertainment, study and advancement, public services, etc., and build a city non-mobilized traffic feature vitality space.

- Kenhuang Square Xiaoyuan Area Development Action: Plan a circular Star Avenue along the non-mobilized traffic route inside the Xiaoyuan area. Gather the contributors, heroes, social volunteers and community groups of the development and construction of the area, display their characters and deeds on the Star Avenue, as the spiritual display wall of the city of TEDA, show the unique urban humanistic charm, and form a city non-mobilized traffic vitality check-in spot with a gathering culture.
- Eighth Avenue Botanical Garden District Development Action: Based on the good garden plants in the botanical garden, the overhead high-voltage corridor and municipal pipe gallery will be treated underground to enhance the non-mobilized traffic space inside and outside the botanical garden. Additional non-mobilized traffic trails will be added in the botanical garden, combined with different plant themes to arrange landscape sketches and street furniture, to enhance the leisure service function of the botanical garden; creating a botanical-themed urban vitality living room for Tianjin Economic-Technological Development Area.

Invitations in Non-Mobilized Traffic Plan

- Creating Artistic Cultural Street Corners

In the TEDA, street corner parks, roadside green spaces, etc., are distributed in a point-like manner at various road intersections, integrating more into the daily lives of residents. Street corner parks can integrate the surrounding architectural spaces and road spaces to facilitate mutual exchange and penetration between the surrounding spaces and the roads, ultimately forming a dynamic and vibrant boundary space. By leveraging street corner parks, urban gray spaces, interesting art designs, street corner sculptures, etc., slow-moving landscape nodes are set up to create artistic street corners and enhance the fun and experience of slow-speed travel. Mainly themed around street corner sculptures, fun art installations, and street corner activity parks, 29 artistic and cultural street corners are arranged in the Tianjin Development Area, highlighting the city's cultural connotations.

- Building Child-friendly Learning Paths

Optimize urban slow trails by viewing the scenery from a one-meter height. Break through the traditional adult perspective and let children view the city from a ‘one-meter height’. Explore elastic and flexible spaces in the city, plan child-friendly rest and play spaces in community parks, street corners, and ‘block gray spaces’, and enhance the safety and fun of slow-speed travel. The whole region has been attached with learning paths and channels plus walking bus channels. This encourages communities to implement walking buses, organize adults to escort children to walk to and from school, and cultivate children's ability to travel independently. The walking bus requires two or more adults to escort and set up ‘bus stops’ along the way for children to join the walking bus and a "pick-up timetable" for passing through each stop. Taking the Experimental School and its surrounding areas as examples, the plan fully consider children's exclusive roads for learning, and set up continuous green belts, facility belts or guardrails between children's learning paths and motorized and non-motorized lanes; important slow intersections are treated with traffic calming measures: raise the road surface at the entrance and exit of motor vehicles to the same elevation as the sidewalk; set up secondary pedestrian safety islands at longer intersections; children's learning paths are designed with colorful trails and zebra crossings, and directions and distances to relevant places are painted on the ground at intersections.

- Implementing AR technology to enhance the interactive experience of the non-mobilized traffic system

Plan a cooperation between TikTok internet shorts platform and Tianjin Internet Information Office to explore a new model of city brand marketing. Mobilize various businesses and cultural tourism reception departments in the Tianjin Development Area, issue consumption coupons, cash coupons, and shopping red envelopes for online and offline interactive experiences. Use the local TikTok App to design AR games, set consumption coupons, shopping red envelopes, etc. in public spaces and slow trails through AR. Users can receive consumption coupons or red envelopes and go to offline businesses for consumption by shooting short videos or completing fitness exercises, strengthening the interaction between online and offline activities. Combining non-mobilized traffic spaces with virtual reality can enhance the interactive experience and the vitality of non-mobilized traffic spaces, which further promoting city brand publicity and influence.

V. CONCLUSION

With the advent of digital economy and sustainable operation, the Tianjin Economic-Technological Development Area, further improves the construction of the city's non-mobilized traffic system. From the perspective of urban planning, this paper discussed relevant strategies that shape new benchmarks for the construction of the city's non-mobilized traffic system, promote the new urban ecology mode and awaken the green function of the city, refresh the high aesthetics of the city and usher in more new development opportunities for the future high-quality development. The core elements of the urban non-mobilized traffic system in the

Tianjin Economic-Technological Development Area has covered various functional nodes of the city, link the points of space, extend the elements of the road, integrate and build the elements of the surface, and finally form a high quality non-mobilized traffic system. The implementation of the plan include the creation of a characteristic non-mobilized traffic space environment, the series connection of fun nodes, the association of commercial nodes, and the planning of online celebrity nodes, plan slow vitality rings. Attention has also been paid to children, and from the children's perspective, the renovation of non-mobilized traffic also need build a child-friendly city through a whole-region learning path.

REFERENCES

[1]. Gehl, J. (1971). Life between buildings : using public space / Jan Gehl ; translated by Jo Koch, Washington, DC : Island Press, 2011
[2]. Meerow, S. (2017). Spatial planning for multifunctional green infrastructure: Growing resilience in Detroit. Landscape and Urban Planning. 159. 62-75.
[3]. Jacobs, J. (1961). The Death and Life of Great American Cities, New York, Random House.
[4]. Pinna, F. (2021). Greenways as Integrated Systems: A Proposal for Planning and Design Guidelines Based on Case Studies Evaluation. Sustainability. 13. 11232.
[5]. Garcia M. (2020). The Unexploited Potential of Converting Rail Tracks to Greenways: The Spanish Vías Verdes. Sustainability. 12. 881.
[6]. Wolch, J. (2010). Proximity and Perceived Safety as Determinants of Urban Trail Use: Findings from a Three-City Study. Environment and Planning A. 42.57-79.
[7]. Lak, A. (2021). Towards a framework for driving sustainable urban regeneration with ecosystem services. Land Use Policy. 111.105736.
[8]. Zhang, Y. (2022). The effects of urban greenway environment on recreational activities in tropical high-density Singapore: A computer vision approach. Urban Forestry & Urban Greening. 12. 76-78.
[9]. Tang, Z. (2020). A data-informed analytical approach to human-scale greenway planning: Integrating multi-sourced urban data with machine learning algorithms. Urban Forestry & Urban Greening. 56.126871.
[10]. Fronczek, M. (2017). Proposal for a Method of Constructing Inclusive Urban Green Infrastructure. European Spatial Research and Policy. 24(1), 81-105.
[11]. Tzortzi, G. (2020). Greenways in Athens, Greece: Enhancing connectivity through a greenway network in a contemporary European metropolis. Urban Research & Practice. 15. 1-33.

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