Journal of Landscape Research 2025, 17(3): 19-22, 26

Strategies for Landscape Renewal in Urban Waterfront Areas: A Case Study of Yichang City

HE Liangjun[1], QIAO Rui[2*]

(1. Yangtze University College of Arts and Sciences, Jingzhou, Hubei 434000, China; 2. Jingzhou Institute of Technology, Jingzhou, Hubei 434000, China)

Abstract Aiming at solving the problems existing in the landscape planning of waterfront areas in Yichang City, such as the contradiction of traffic organization, the waste of historical space resources and the insufficient utilization of hydrological characteristics, systematic renewal strategies were proposed. Through empirical research and spatial behavioral analysis, a renewal paradigm of "ecological restoration-cultural inheritance-spatial creation" was constructed according to topographic texture and hydrological characteristics. The innovation lies in proposing a renewal model of vertical corridors that integrates "transportation, ecology and landscape", as well as a three-dimensional transportation scheme for separating pedestrians and vehicles based on the theory of alleviating spatial ownership contradictions. This study provides a technical path for improving the functions of high-density urban waterfront areas and optimizing their spatial efficiency, and has a practical value for enhancing citizens' water-friendly experiences and promoting cultural and tourism economy.

Keywords Landscape renewal in waterfront areas, Three-dimensional traffic organization, Accessibility optimization, Integration of multi-functional space

DOI 10.16785/j.issn 1943-989x.2025.3.004

Waterfront areas, as a specific geographical unit in the urban spatial structure, are defined as the collection of land use entities and their affiliated buildings and structures adjacent to natural water bodies (including rivers, lakes and oceans)[1]. According to the differences in hydrological characteristics, it can be subdivided into three typical types: riparian, lakeside and coastal zones[2]. This area constitutes the most biologically diverse sensitive area in the urban ecosystem due to its water-land interaction characteristics. From the perspective of spatial composition, urban waterfront space encompasses three elements: waters, water-land junction zones, and areas adjacent to land, and usually extends to the land area within 200−300 m away from the boundary of water body[3]. As a key subsystem of urban open space system, waterfront space has the dual attributes of a natural ecological substrate and a carrier of humanistic landscape. It is not only the core field for realizing urban water-friendly activities, but also a landscape catalyst for shaping urban image[4]. It can be seen that the planning and construction of such space can not only enhance the quality of life of citizens by providing diverse recreational functions (including landscape appreciation, social gatherings and cultural and sports activities), but also increase regional attractiveness by optimizing urban appearance, thus developing into strategic nodes for showcasing urban image and driving tourism economy. More importantly, scientific development strategies of waterfront space can not only achieve the coordinated development of human settlement environment and the ecosystem, but also promote the upgrading of urban economic structure and the construction of brand image through the transformation mechanism of spatial value, ultimately forming a sustainable path for enhancing urban competitiveness.

1 Problems existing in the landscape planning of waterfront areas in Yichang

Based on the empirical research on Yichang City, it is found that the landscape planning of urban waterfront areas has the defect of systematic functional integration. Firstly, there is a dual contradiction at the traffic organization level. That is, pedestrians and vehicles are not separated by green isolation belts on the walkways along a waterfront expressway, which not only threatens the safety of pedestrians but also reduces their travel experience. However, the passageways constructed by using revetments overly emphasize the passability function, and lack resident nodes and micro-space design, so that the utilization efficiency of their space is limited. Secondly, there is a significant waste of historical space resources. The original wharf and ramp space were not adaptatively renovated during the demolition process, turning the waters space regional characteristics into a negative site. This not only leads to the disappearance of cultural heritage carriers, but also essentially occupies the waterfront interfaces that can be developed into citizens' activity space. It is particularly worth noting that the shaping effect of hydrological characteristics on spatial structure has not been effectively transformed. The changes in the water level of the Yangtze River should have formed gradient spatial hierarchy. However, due to the lagging construction of downstream channels, the waterfront interface under the embankment is in a fragmented state. That is, elements such as hard revetments, gravel beaches and abandoned anchor chains coexist in a disorderly manner, which not only disrupts the continuity of landscape, but also restricts the accessibility of citizens to waters. This separation of ecological elements and activity space eventually leads to waterfront areas becoming marginal space with low use efficiency.

2 Strategies for landscape renewal in urban waterfront areas

2.1 Building a convenient and comfortable external transportation system

Improving the vitality of waterfront space should be based on the optimization of accessibility, and its essence lies in establishing a human-oriented spatial interaction mechanism. As the core element of landscape system reconstruction in waterfront areas, accessibility not only characterizes the utilization efficiency of space, but also directly affects the realization of the social value of a place[5]. At the planning and design level, the primary task is to establish a

Received: March 16, 2025 Accepted: May 20, 2025

* Corresponding author.

multimodal transportation connection mechanism between waterfront space and urban functional areas to ensure that the accessibility threshold of external transportation network meets public service demands, thereby transforming waterfront space from geographical concept into functional urban interface. Although the traffic efficiency of waterfront expressway system across regions in Yichang City has been improved, a spatial barrier effect has been formed in the perpendicular connectivity of the water-land interface. The siphoning effect of this linear infrastructure leads to the formation of a fragmented development pattern between waterfront areas and hinterland cities. It is worth noting that although the traditional linear zebra crossing layout can partially alleviate access obstacles, dense planar pedestrian crossing facilities not only weaken the traffic efficiency of rapid traffic corridors but also pose potential traffic safety risks due to frequent conflicts between pedestrians and vehicles. This phenomenon reveals the necessity that the accessibility optimization of waterfront areas needs to break through the two-dimensional planar thinking and turn to three-dimensional traffic organization.

Based on the theory of alleviating spatial ownership conflicts, it is suggested to implement the "separation model of pedestrians and vehicles" to deconstruct the interface conflicts between waterfront roads and waterfront areas. Lowering the motor vehicle lanes along a waterfront road to the underground layer, especially in high-intensity pedestrian concentration areas such as the Wanda commercial and residential complex and the Jiefang Road Pedestrian Street, not only can effectively reduce the interference of traffic pollution on waterfront ecological corridors, but also eliminate the physical barriers to citizens' water-related activities. Based on this, a complete slow-moving network system can be constructed on the ground, which not only ensures the efficiency of road traffic but also enhances the environmental quality and landscape continuity of waterfront space. In view of the functional difference characteristics along waterfront roads, a strategy for constructing two-level pedestrian system is proposed. This section from Gangyao Road to Baisha Road is mainly composed of office buildings and medium- and low-density residential clusters, and the intensity of conflicts between people and vehicles is relatively low. An approach of "point-line" combination can be adopted to form a continuous pedestrian corridor complementary to the ground by setting up three-dimensional pedestrian crossing facilities such as overpasses or underground passages across a street. This strategy can not only maintain the traffic efficiency of motor vehicles, but also establish a safe and convenient waterfront accessible path, thus achieving a balance between traffic efficiency and spatial quality. It is needed to give priority to the development of a low-carbon travel mode oriented by public transportation and the establishment of a waterfront bus rapid transit (BRT). The layout of bus stops and route network should be optimized to achieve the functional coupling with waterfront space. Specifically, multi-level bus hub nodes should be set up along a waterfront expressway to build a water bus connection system linking urban rail transit stations. Meanwhile, based on the prediction model of traffic demand, the parking capacity of parking lots and the parking facilities of bicycles should be scientifically allocated to form a "P+R" transfer system. This multi-level transportation organization model can meet diverse travel demands, enable walking, cycling, public transportation and private motorized transportation to efficiently access waterfront open space, and ultimately achieve the organic integration of waterfront areas and urban transportation network.

2.2 Increasing guiding traffic roads perpendicular to the river

The improvement of accessibility for waterfront plots should follow the principle of networking perpendicular transportation corridors, and the core is to strengthen the axial permeability efficiency of water system to enhance the gravitational pull of people moving towards water[5]. Empirical research shows that the current walking pattern accounts for 72.6% of waterfront visiting behaviors. However, the current perpendicular walking channels have problems such as space occupation and lack of environmental comfort, resulting in a significant decline in the quality of citizens' water-friendly experiences. Based on this, a two-dimensional update strategy is proposed as follows.

Emphasis is placed on constructing a perpendicular guiding slow-moving network system, and spatial accessibility coefficient is enhanced by enhancing the density of waterfront connection paths. Specifically, it is recommended to adopt a topological structure of "linear penetration +node reinforcement", and add three levels of perpendicular corridors (the spacing of the main corridors, secondary corridors, and capillary corridors is $\leqslant$ 500 m, $\leqslant$ 300 m, and $\leqslant$ 150 m, respectively) on the basis of the current road network, thereby forming a clearly graded hydrophilic path system. Simultaneously, it is needed to implement the plan for improving the quality of street space, and transform perpendicular corridors into composite cultural landscape carriers. By embedding landscape narrative sequences (including regional cultural landscape walls, public art installations, ecological identification systems, etc.) and combining with street pocket parks, service facilities in a walking circle within 8-15 min are formed. This design strategy not only enhances spatial recognicability (increasing orientation recognition by 40%), but also builds an immersive walking experience of "changing scenes with every step", so that perpendicular transportation corridors become a green cultural bond connecting urban hinterland and waterfront areas. The implementation of this strategy by the system can produce three spatial effects. Firstly, a 15-minute waterfront living circle is formed to enable 80% of urban residents to reach waterfront space under non-motorized travel conditions. Secondly, the connectivity index of ecological network is improved by connecting green corridors. Thirdly, the comfort of non-motorized vehicle travel is enhanced to simultaneously achieve the construction of a low-carbon transportation system and the relief of urban traffic pressure. This model provides a replicable technical path for optimizing the spatial efficiency of high-density urban waterfront areas (Fig.1).

2.3 Building a multi–level slow–moving transportation system that is fully connected

As a unique spatial form of waterfront landscape belts, perpendicular traffic corridors combine perpendicular access function and landscape identification value. Its safety and comfort design directly determines the accessibility level of waterfront space and affects the frequency of citizens' water-related activities. It is found that the existing perpendicular transportation facilities have three major systematic defects: continuous steps lack buffer platforms (average interval >50 steps); the step size does not meet the ergonomic standards (step distance <25 cm); auxiliary facilities are missing (handrail setting rate <35%), resulting in a relatively high safety risk coefficient. Based on the principles of spatial behavior science, the renovation of perpendicular trails should follow the principle of "giving priority to safety and

putting equal emphasis on efficiency". In terms of material selection, sintered quartz tiles or rough-faced granite with an anti-slip coefficient of ⩾ 0.6 should be given priority to ensure the safety of all-weather use. Step parameters need to comply with the BS 5395-1 standard. It is recommended that step height should be 15–17 cm, and step distance should be 28–32 cm. Meanwhile, a 1.8 m×2.4 m rest platform should be set up every 15 steps, and anti-rust steel handrails with a height of 110 cm should be installed along both sides to form a continuous protection system.

The transportation system perpendicular to the river should be transformed into a multi-dimensional landscape medium and achieve functional upgrades through a three-level design strategy. Morphological adaptation: according to terrain gradient (ΔH ranges from 3 to 8 m), a zigzag- or arc-shaped step layout is adopted, forming a topological correspondence relation with the shoreline terrain (Fig.2). Ecological intervention: a modular vertical greening system is implanted on the side walls of the steps (vegetation coverage rate ⩾ 60%) to construct a biofriendly microhabitat. Color narrative: light gray paving is adopted to enhance the depth of riverside space, and warm tones can be used locally in the node areas to form visual anchor points.

This optimization model can generate dual benefits: in the functional dimension, it enhances perpendicular transportation efficiency to the river and reduces accident rate; in the landscape dimension, a linearly expanded three-dimensional landscape sequence is formed to vertically extend citizens' activity space to the fluctuation area of water level, thereby expanding the usable area of waterfront areas. This renewal strategy composed of "transportation, ecology and landscape" provides an innovative solution for the regeneration of height-difference waterfront space.

2.4 Increasing internal connectivity

Waterfront landscape space has dual spatial attributes. That is, it is not only an important carrier of urban public activities but also a key node of water transportation network. Empirical research shows that the location selection of public service facilities (such as docks and tourist centers) often leads to spatial functional conflicts. For instance, the convenient Three Gorges Tourist Center and its supporting docks built in waterfront Wanda section in Yichang provide tourism service functions, but disrupts the continuity of the waterfront space. Only a 1.5-meter wide linear pedestrian passage is retained, resulting in a reduction in the service radius of hydrophilic corridors and a decrease in the spatial permeability coefficient.

For the blocking effect of buildings, a spatial superposition design strategy is proposed as follows. Vertical integration: spatial interface is reconstructed by elevating the ground floor of a building and underground passage system (clear height ⩾ 3.5 m) to maintain the continuity of waterfront pedestrian corridors. Three-dimensional connection: a landscape bridge (with a span of 15–30 m) is adopted to connect the public platform on the second floor of a building with waterfront walkways, forming a three-dimensional pedestrian network. Roof utilization: the roof of a building is transformed into a viewing platform (green coverage rate ⩾ 40%), and seamless connection with the walkways on the top of an embankment can be achieved through a gentle slope walkway system (slope ⩽ 8%).

For Shanghai Taitongzhan Ferry, the three paths of running, strolling and cycling were once interrupted by Taitongzhan Pier. The slow bridge brings the three streams of people together and allows them to cross at the second-floor platform of the pier, achieving the connection of the three lines (Fig.3). Meanwhile, the design takes into account the flow of people who cross the bridge and the landscape belt to take a walk by the river. A square under the bridge is designed in the eastern middle of of Taitongzhan to guide the crowd to the river. A courtyard and a path are designed in the corner space on the west side of Taitongzhan to provide passage and rest areas for people taking a walk by the river.

According to the guiding requirements of the upper-level planning system for the construction of waterfront space, the construction of waterfront landscape space in Yichang City needs to systematically integrate elements and resources such as terrain texture, ecological base, hydrological characteristics and historical remains, so as to construct a spatial system with regional identification. Based on the analysis of the differences in spatial form characteristics, landscape traits and functional carrying capacity, the waterfront space is classified into five major types: historical and cultural type, life and recreation type, tourism and sightseeing type, business and leisure type, and natural suburban type (Fig.4). The establishment of this classification system not only provides a differentiated judgment framework for the comprehensive evaluation of waterfront space, but also promotes the dynamic adaptation of functions of public space with the activity demands of citizens and the development goals of the city through precise functional guidance and control strategies, thereby enhancing the functional effectiveness of landscape space[6].

Based on the research on the spatial characteristics of waterfront areas in Yichang, future renewal strategies should break through the simple functional increment model, and shift to improving the quality and efficiency of landscape functions in the built-up areas. Specifi-cally, it is necessary to establish a renewal paradigm of "ecological restoration-cultural inheritance-

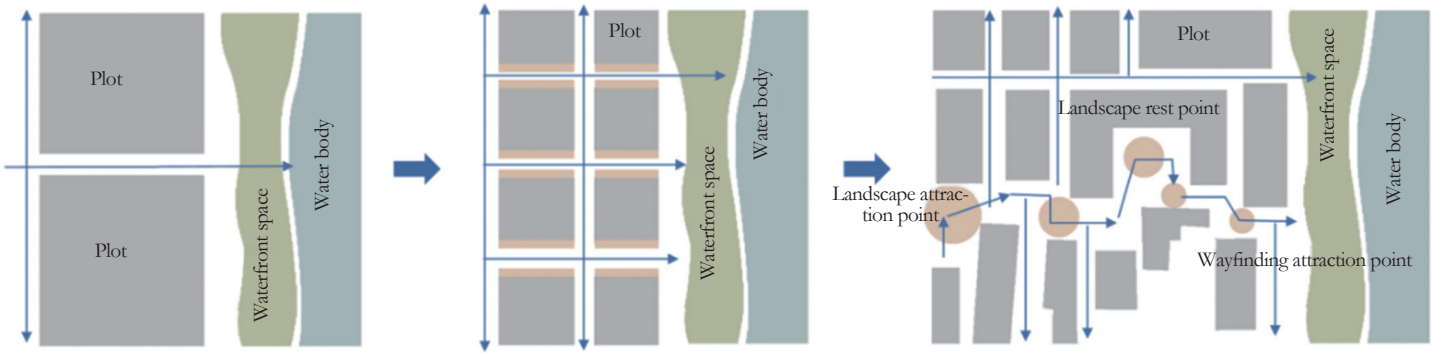

Fig.1 Adding perpendicular guiding traffic and multi-objective guidance

space creation", and the following transformations should be achieved. Firstly, cultural exploration and spatial reconstruction should be carried out on the remains of industrial docks to transform them into citizen activity nodes with the characteristics of viewing and being close to water, effectively meeting the public's needs for water-friendly experiences and leisure fishing. Secondly, the optimization of architectural forms and the reshaping of interfaces are conducted to promote the organic integration of existing commercial space and waterfront environment, simultaneously enhance the accessibility and landscape coordination of commercial streets, and shape characteristic waterfront commercial landscape corridors. Furthermore, for negative space with single functions, based on the endowment of site resources and the nature of surrounding land, composite functional modules such as cultural display, ecological science popularization (wetlands/rain gardens), cultural tourism and commercial, and sports and fitness can be implanted.

This update path has dual benefits. At the micro level, it can enhance the efficiency of space utilization and meet the diverse activity needs of citizens such as socializing and recreation. At the macro level, the strategy of functional superimposition is implemented to construct a waterfront open space system integrating multiple values such as cultural experience, commercial services, ecological education, and health and sports, ultimately achieving a spatial paradigm transformation from single function orientation to comprehensive benefit orientation.

Fig.2 Steps perpendicular to the river

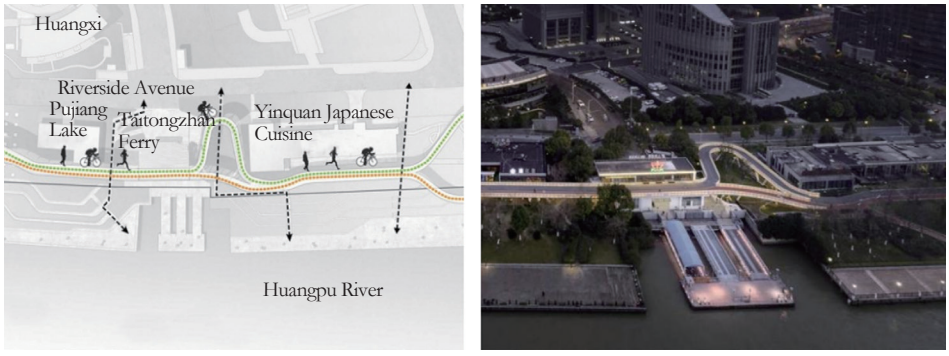

Fig.3 Slow bridge blending seamlessly with the buildings at Taitongzhan Pier

3 Conclusion

Urban waterfront areas are the core space where urban ecology and culture interweave, where landscape renewal is not only the recon-struction of spatial form but also the dynamic adaptation of urban functions and the needs of citizens. In this study, to solve the practical problems such as the contradiction of traffic organization, the waste of historical resources and the insufficient utilization of hydrological characteristics in the waterfront areas of Yichang City, systematic renewal strategies of "ecological restoration - cultural inheritance-space creation" were proposed. By the construction of a vertical corridor model integrating "transportation-ecology-landscape", a three-dimensional transportation system that separates pedestrians and vehicles, and a multi-level slow-moving network perpendicular to the river, the predicament of insufficient accessibility and low spatial efficiency in waterfront areas was effectively solved to provide a technical path for improving the functions of high-density urban waterfront areas.

In this study, traffic organization was integrated with ecological restoration and cultural

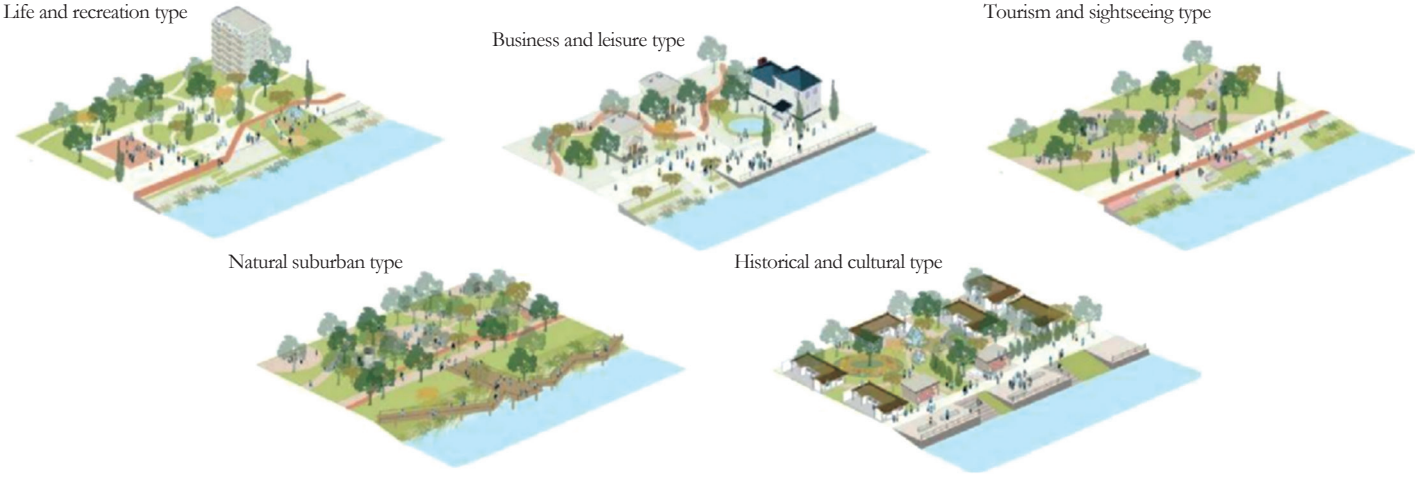

Fig.4 Five types of waterfront space

(To be continued in P26)

evaluations in the future.

(2) When utilizing "One Map" forest resource management system of forestry sector and the annual updated results of the Third National Land Survey as reference basemaps for afforestation space suitability investigation, discrepancies in land type identification standards between the 2 systems may lead to misclassification. Some land parcels that should be inculded in suitable afforestation areas might be identified as "unsuitable" by mistake. Furthermore, areas beyond the current evaluation scope—including rural peripheral spaces ("four-side" gapes), abandoned mining sites, and strictly controlled land types—also possess potential for afforestation. Therefore, it is recommended that relevant authorities enhance coordination to unify land classification standards at the technical level. This standardization will enable truly rational and accurate evaluation, ultimately achieving the goal of scientifically planning afforestation spaces.

(3) The various ecological restoration projects implemented by forestry and grassland departments — including low-quality and inefficient forest transformation, degraded forest rehabilitation, and similar initiatives — are carried out through methods like manual afforestation, aerial seeding and forest quality improvement. These projects constitute an integral component of national land greening efforts. However, current afforestation space suitability evaluation fail to adequately account for these restoration-oriented afforestation demands. It is theretofore recommended that subsequent national land afforestation planning should proactively allocate dedicated afforestation and task quotas for the diverse ecological restoration projects administered by forestry and grassland departments at all levels.

References

[1] Ministry of Natural Resources of China, National Forestry and Grassland Administration of China. (2021). *Technical Scheme for Investigation and Evaluation of Afforestation Space*, 6-18.

[2] General Office of the State Council of China. (May 18, 2021). *Guiding Opinions of the General Office of the State Council on Scientific Greening* (*State Council Document No.19*). Retrieved from https://www.gov.cn/gongbao/content/2021/content_ 5618943.htm.

[3] Zhao, H., Shen, J.Y. & Chen, Y.X., et al. (2022). Thoughts on the path of implementing afforestation space based on territorial spatial planning. *Forestry Resources Management*, (6), 26-29.

[4] Yao, F., Wan, M. & Liang, F., et al. (2023). Preliminary study on forestry control model and achievements of Karst rocky desertification in Nanyang. *Journal of Henan Forestry Science and Technology*, (3), 31-33, 57.

[5] Yang, B.Y., Li, J.L. (2024). Investigation and evaluation on spatial suitability of afforestation and greening in Yunnan Province: Take Dali Prefecture as an example. *Forestry Science and Technology Information*, *56*(1), 5-10.

[6] Kuang, X.F., Yang, J.K. (2024). Research on applied technologies of land classification assessment in afforestation spatial survey. *Yunnan Forestry*, (5), 62-65.

[7] Wang, J. (2023). Study on Potential and Zoning of Comprehensive Land Consolidation in Gaoling District, Xi'an, Shanxi, China (Master's thesis). Retrieved from China National Knowledge Infrastructure.

[8] Deng, W.G., Mo, L.T. & Li, M.Y., et al. (2024). Exploration and thinking on clarifying the investigation and evaluation of afforestation space suitability in land space planning -- Taking Qiannan Prefecture of Guizhou Province as an example. *Forestry Science and Technology Information*, *56*(2), 73-75.

[9] Du, Z.Y. (2024). Discussion on the implementation path of logical inspection of patch attribute data in afforestation space investigation and evaluation. *Forestry Science and Technology*, (6), 16-22.

[10] Henan Provincial Department of Natural Resources, Henan Forestry Administration. (2022). *Technical Scheme for Afforestation Spatial Survey and Evaluation in Henan Province*.

****

(Continued from P22)

display, and through strategies such as the networking of vertical corridors and spatial superimposed design, the continuity, safety and cultural recognizability of waterfront space were strengthened. However, the public participation mechanism is relatively weak in the planning and implementation, and fails to fully integrate community needs and local wisdom, which may lead to deviations between the use of space and the expectations of citizens. In addition, the feasibility analysis of economic costs and long-term maintenance has not been systematically carried out yet, which may affect the sustainable promotion of the strategies. Overall, this research provides a scientific and operational paradigm for the landscape renewal of waterfront areas, and its concepts and methods have important reference significance for the regeneration of waterfront space in cities of the same type.

References

[1] Breen, A. (1996). *The new waterfront*: *A worldwide urban success story*. New York: McGraw-Hill.

[2] Wang, Y., Sheng, J. F. (2002). The function of waterside related to urban development. *Scientia Geographica Sinica*, (1), 12-17.

[3] Zhou, Y. G., Shen, X. W. (2011). Research on the development orientations of urban waterfront based on space-time dimension. *Urban Problems*, (2), 30-35.

[4] Shen, L. C. (2000). Comprehensive planning model for the development of waterfront areas: A case study of the control detailed planning of Nanbin−Gezhou Area in Shantou City. *Planners*, (1), 32-35.

[5] Jiang, P. P., Fan, W. (2021). Study on planning and design methods of urban waterfront public space: A case of Nanyang River waterfront space in Laizhou, Yantai. *Urbanism and Architecture*, *18*(35), 184-187.

[6] Yang, C. X., Xu, S. L. & Geng, H. Z. et al. (2022). Diagnosis and optimization of waterfront public space in north bund, Shanghai based on multi-agent behavior simulation. *Landscape Architecture*, *29*(12), 78-84.