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**Study on the Optimization Design of Negative Space in Maanshan
Historical Ancient Towns under the Concept of Symbiosis**

— Taking Yuncao Town as an Example

Qualification work for obtaining the HED «Master» in the specialty 022 Design, educational-
professional program "Environmental Art Design"

The qualification work contains the results of own research

The use of ideas, results and texts of other authors must be referenced to the appropriate
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Abstract

Against the background of urbanization and cultural-tourism development, Yuncao Town, a historical ancient town in Maanshan with thousand-year-old canal-transportation cultural heritage, has produced a large quantity of negative spaces, including abandoned old canal wharves, disconnected back-street lanes and dilapidated historical courtyards. These negative spaces break the integrity of ancient-town spatial fabric and trigger two-sided conflicts: tourists cannot gain deep-level cultural immersion, while local residents lack public territories for daily activities. Conventional renewal approaches that prioritize visual effect over practical function and tourist consumption over residents' livelihood fail to satisfy the requirements of living-heritage conservation and sustainable development for ancient settlements.

The concept of symbiosis offers a new theoretical perspective to resolve above-mentioned contradictions. Taking negative spaces of Yuncao Ancient Town as research object, this thesis follows the research logic: theoretical sorting-out, field empirical investigation, extraction of optimization strategies, design-project implementation. Field surveys identify multiple types of negative spaces and analyse their formative mechanisms. This paper clarifies the core demands of two major user groups: tourists expect immersive canal-transportation cultural experience, attractive landscape and convenient recreation infrastructure; local residents require places for physical exercise, social communication and basic community services. Based on empirical investigation, a three-dimensional symbiosis theoretical framework is constructed, covering human-human symbiosis, space-human symbiosis and space-culture symbiosis. Taking the waterfront territory of the former canal-transportation wharf as typical design site, a micro-renewal integrated project of "cultural-exhibition belt, waterfront-recreation belt, shared-activity belt" is proposed, which transforms abandoned negative spaces into activated public spatial nodes.

The research results can serve as a replicable practical model for similar canal-transportation ancient towns in China, so as to realize spatial revitalization, regional-cultural inheritance and balanced co-existence of residents and tourists.

Key Words: Symbiosis Concept; Yuncao Ancient Town; Negative Space; Canal-Transportation Culture; Micro-renewal

INTRODUCTION

As a material carrier embodying canal-transportation trade memory, the protection and revitalization of historical ancient towns have become important issues in China's urbanization process. However, most of the current renewal practices have fallen into a double predicament: On the one hand, renovation merely focuses on facade beautification and stylized visual performance; on the other hand, practical daily-life functions and the real demands of permanent residents are ignored. The former often produces "photo-oriented" public spaces with decorative appearances but insufficient practical support for real-life activities. The latter leads to the phenomenon that tourists cannot obtain in-depth cultural-heritage experience, while local inhabitants are short of public spaces for social interaction and community services, triggering prominent socio-spatial contradictions.

Yuncao Town, located in Hanshan County, Maanshan City, Anhui Province, was designated as a Chinese Historical and Cultural Town in 2014. It is a typical Jianghuai ancient town shaped by canal-transportation trade, forming the historical spatial pattern of "one river runs through the town, three parallel main streets, five interconnected alleys, dense courtyards". With the decline of water-borne transportation, many inner-town territories have degraded into negative spaces: former transport wharves lie idle, back-street pedestrian connections are broken, and numerous historical courtyards fall into disrepair.

The symbiosis concept originated from biology and was later introduced into architecture and urban planning. Kisho Kurokawa's symbiotic-city theory advocates the co-existence of history and modernity, nature and artificial environment, and diverse social groups. Symbiosis thinking provides alternative theoretical tools to tackle negative-space renewal problems in Yuncao Ancient Town. This study combines symbiosis theory with the regeneration of canal-transportation ancient-town negative spaces, establishes a three-dimensional theoretical framework adapted to local settlement characteristics, and adopts low-intervention micro-renewal design approaches. It strives to balance the cultural-experience demands of tourists and daily-life needs of residents, and achieve coordinated symbiosis among space, human beings and regional culture.

Chapter 1

Historiography of the Issue and Research Methods

1.1 Review of the Literature

Foreign academic circles have accumulated long-term research achievements on historical-quarter renewal, focusing on low-intervention micro-renewal, mixed-function solutions, public participation and organic embedding of local cultural heritage into spatial objects. Nevertheless, foreign practical experience is generated under European and Japanese historical-settlement backgrounds, which cannot be mechanically copied for Chinese canal-transportation ancient towns characterized by the "river-wharf-street-lane" spatial axis.

In symbiosis-theory domain, Kisho Kurokawa's monograph *Symbiotic City* constitutes the fundamental theoretical document, putting forward symbiosis principles between history and modernity, artificial environment and nature, diverse social groups. The renewal project of Gion-cho district in Kyoto implements micro-intervention regeneration for negative narrow alleys between traditional machiya wooden buildings, with foldable seating and compact cultural-display stands installed.

Chinese scholars have carried out abundant studies on historical-ancient-town renewal, mainly covering external-style preservation, functional modernization and regional-culture implantation. However, specialized research targeting negative-space territories of canal-transportation ancient towns and balanced demand satisfaction for residents and tourists remains insufficient. Wang Peng classifies urban negative spaces into three types: function-deficit type, poor-environmental-condition type, low-accessibility type. Li Chi supplements the typology with cultural-symbol-loss negative-space.

Generalization of analysed academic sources identifies three key research gaps: first, specialized research targeting canal-transportation ancient towns with "river-wharf-street-lane" layout is insufficient; second, complete systematic theoretical framework constructed under symbiosis-theory principles is absent; third, compound research integrating regional-cultural-symbol translation, negative-space revitalization and dual-group joint-territory utilization is scarce.

1.2 Definition of Basic Concepts

Symbiosis Concept: The term originates from biology and means mutually-beneficial co-existence of different organisms. Within this qualification work, symbiosis is divided into three mutually connected dimensions: human-human symbiosis, space-human symbiosis, space-culture symbiosis.

Negative Space of the ancient town: fragmented idle territories inside historical-ancient-town boundaries, with potential location or cultural-heritage value, yet suffering poor environmental state, insufficient infrastructure, low accessibility and social-function loss. Three typologies are distinguished: function-deficit, poor-environment, cultural-loss.

Canal-transportation Ancient Town: Historical settlement formed and developed relying on canal water-borne trade. Yuncao Ancient Town serves as typical Jianghuai canal-transportation town with complete spatial sequence "wharf-street-lane-merchant building".

Micro-renewal: Low-intervention small-scale regeneration approach rejecting large-scale demolition and new construction, revitalizing through infrastructure supplementation, local-environment renovation, function reorganization and cultural-symbol re-interpretation.

1.3 Research Methods

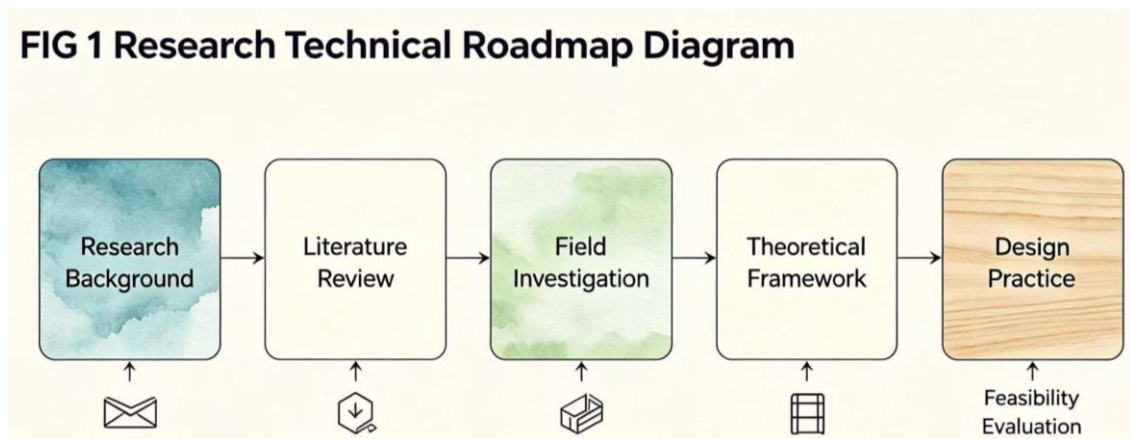


FIG 1 Research technical roadmap diagram

Method of scientific-source analysis: collect and study monographs, journal articles and dissertations concerning symbiosis theory, negative-space research, canal-transportation-ancient-town preservation, and local historical documents including Yuncao Town Chronicle and Conservation Plan of Yuncao Historical-Cultural Town.

Field-investigation method: comprehensive on-site survey for the 1.2 km² historical core zone, with three observation time intervals: working-day daytime, weekend daytime, evening-time. Negative-space locations are mapped; indicators covering accessibility, infrastructure condition, environmental quality are recorded.

Method of questionnaires and semi-structured in-depth interviews: distribute questionnaires for local permanent residents and visiting tourists, conduct semi-structured interviews with ancient-town administrative staff and elderly long-term inhabitants, revealing explicit and implicit demands of two user groups.

Case-study method: select five representative domestic and foreign practical cases: Gioncho renewal (Kyoto), Castlefield district regeneration (Manchester), Pingjiang-Road renewal (Suzhou), Gaoyou canal-transportation ancient town, Hongcun historical village. Conduct comparative analysis and extract valuable practical experience.

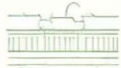
Case	Waterfront Heritage	Public Space	Local Material	Cultural Symbol
Gion				canal network
Kyoto				timber structure
Castlefield Manchester				stone pavement
Pingjiang Road Ancient Town				waterfront access
Hongcun Village				

FIG 2 Case comparative-analysis diagram

Chapter 1 :Conclusion

Chapter 1 carries out sorting-out and analysis for domestic and foreign academic documents, identifies three key research gaps. Core concepts are defined: symbiosis concept, negative space of the ancient town, canal-transportation ancient town and micro-renewal. The whole set of adopted research methods is described in detail.

Chapter 2

Theoretical and On-Site Analysis of the Research Object

2.1 Theoretical Adaptability of the Symbiosis Concept

The symbiosis concept presents high adaptability for solving negative-space-optimization tasks of Yuncao canal-transportation ancient town, manifested along three key dimensions.

Human-human symbiosis dimension: traditional ancient-town-regeneration approaches often unilaterally prioritize either tourist-oriented or resident-oriented interests. Symbiosis thinking advocates mutually-beneficial co-existence of diverse social subjects. For Yuncao Ancient Town, human-human symbiosis means coordinated satisfaction for tourist cultural-experience tasks and residents' daily-life demands, mitigated through time-sharing-use techniques, special-purpose-and-shared-territory zoning and joint-event programming.

Space-human symbiosis dimension: core thesis is that space serves human beings, while human activities transform space in return. One important formative reason for Yuncao negative spaces lies in severe mismatch between territorial functional filling and real-life user demands. Guided by space-human-symbiosis principles, negative-space renewal rejects decorative "stage-set-style" reconstruction, implanting composite flexible functions based on empirical user-demand data.

Space-culture symbiosis dimension: this dimension resolves the widespread problem of superficial decorative-cultural-symbol application, when images are simply printed on walls without connection with real-life spatial functions. Space-culture symbiosis requires that cultural heritage is not limited to static exhibition objects, but embedded in behavioural scenarios of territory use, through extraction of cultural symbols, abstract re-interpretation, and reconstruction of historical-life scenes.

2.2 General Characteristics of Yuncao Ancient Town



FIG 3 Location and research scope map

Yuncao Ancient Town is located in the southern part of Hanshan County, Maanshan City, on the banks of the Canal River. It received the status of Chinese Historical-Cultural Town in 2014. The settlement reached its heyday in the Ming-Qing dynasties due to canal-transportation trade, forming the historical layout "one river crosses the town, three parallel main streets, five interconnected alleys".

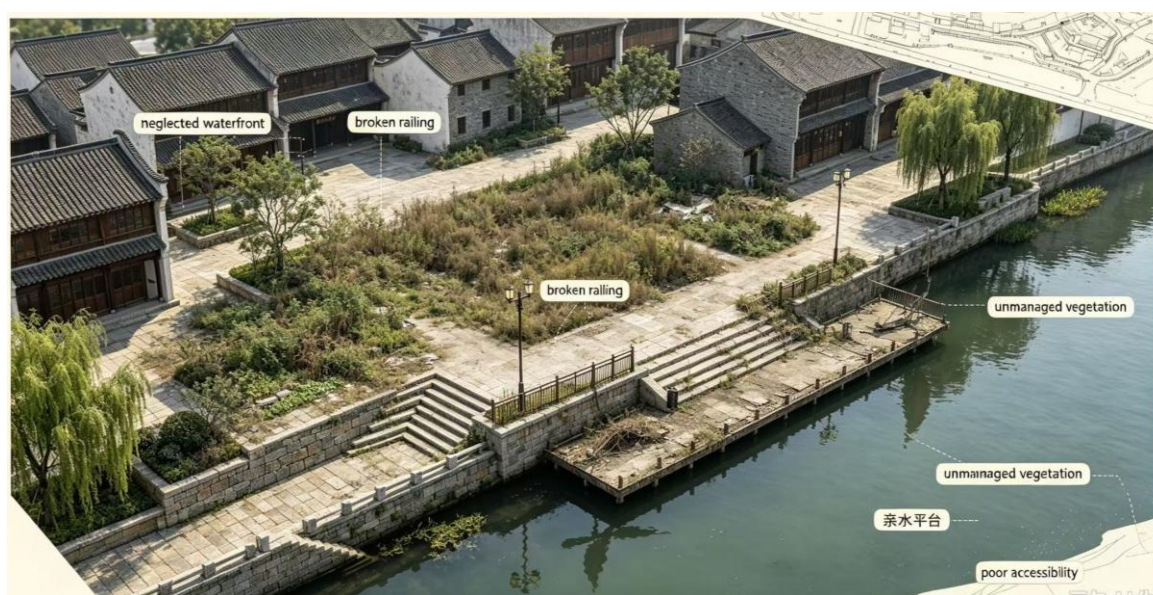


FIG 4 Current-situation aerial schematic

In modern-day conditions, the development of railway and highway transport led to the decline of water-borne canal-transportation. Population outflow is observed in the ancient-town territory. A large number of waterfront wharf territories, back-street lanes and historical courtyards are idle and fall into disrepair, forming extensive negative-space zones.



FIG 5 Distribution map of three types of negative-space

The research covers the historical core zone with an area of about 1.2 km². The key design-project site is the waterfront territory of the historical canal-transportation wharf with an area of about 2000 m². The territory adjoins the Canal River, with fragments of historical wharf stone steps and embankment preserved. On one hand, the site is adjacent to tourist routes; on the other hand, it borders residential quarters of local inhabitants, making it a typical representative example.

2.3 Typology, Distribution and Causes of Negative-Space Formation

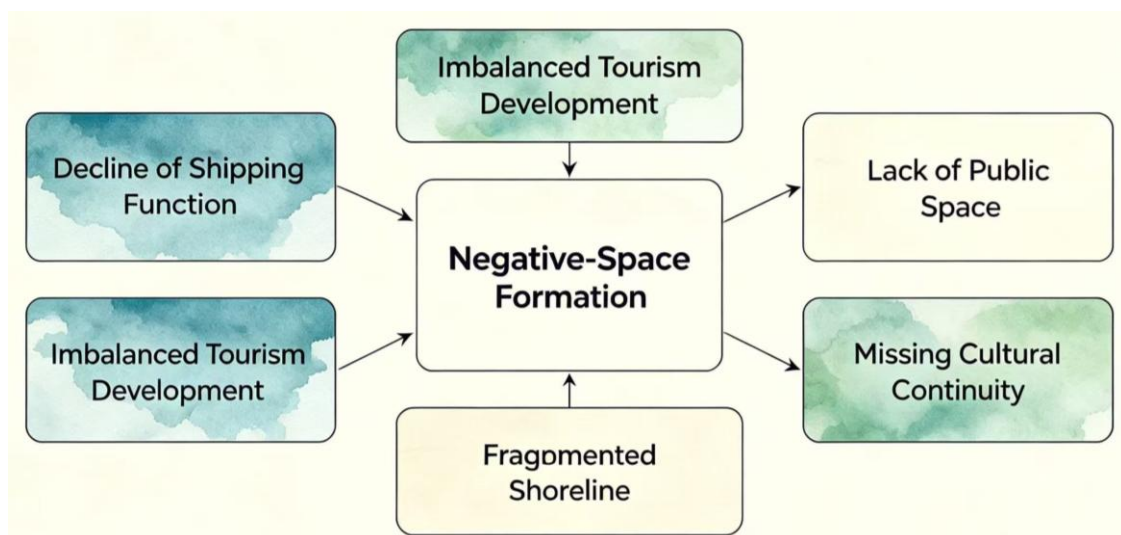


FIG 6 Negative-space cause-analysis diagram

Based on field reconnaissance, negative-space territories are identified and classified into three types. Function-deficit negative-space territories are concentrated along the waterfront

belt of the Canal River, in the zone of former transport wharves. Poor-environment negative-space territories are widespread in the zone of back-street lanes and historical courtyards. Cultural-loss negative-space territories are mainly located near tourist routes, where physical heritage is preserved but historical narrative has disappeared.

Key reasons for negative-space formation: first, transformation of transport functions and decline of canal-shipping; second, distorted priorities of ancient-town renewal, emphasizing external stylistic appearance to the detriment of real-life functional content; third, unbalanced cultural-tourism development, prioritizing tourist consumption while ignoring residents' livelihood needs; fourth, static approach to cultural-heritage preservation, keeping only physical objects without translating historical narrative into space; fifth, lack of long-term operation and maintenance after partial repair.

Combined with the field survey scope of the 1.2 km² historical core zone of Yuncao Ancient Town, this study further subdivides negative-space into three targeted categories adapted to canal-transportation ancient-town characteristics: function-deficit negative-space, poor-environment negative-space and cultural-loss negative-space. Function-deficit negative-space is mainly distributed along the waterfront canal belt and abandoned wharf sites. These territories possess superior geographical location and waterfront landscape resources, yet lack complete public-service configuration. Although the physical infrastructure such as wharf stone steps and revetment still exist, they cannot carry effective public activities, resulting in long-term idle status. Poor-environment negative-space widely spreads among back-street lanes and dilapidated historical courtyards. Such spaces suffer from damaged pavement, broken railing facilities, overgrown weeds, poor pedestrian connectivity and insufficient lighting systems. Some alley segments are blocked by temporary illegal structures, which further weaken the accessibility of inner residential blocks. Cultural-loss negative-space mostly appears around tourist routes. The physical historical heritage remains intact, but local canal-transportation historical narrative and cultural memory have gradually disappeared from daily spatial experience. Simple decorative commercial posters or generic landscape ornaments replace authentic local cultural symbols, leading to spatial cultural amnesia.

It should be emphasized that most real-world sites inside Yuncao Ancient Town exhibit composite attributes rather than belonging to a single type. The core design site---the waterfront wharf area simultaneously belongs to function-deficit negative-space and cultural-loss negative-space. It not only lacks supporting public functions for residents and

tourists, but also loses the tangible carrier for passing-on canal-transport history. Therefore, single-target renovation cannot solve multi-dimensional defects of composite negative-space. When analyzing formation causes, besides shipping decline, distorted renewal concepts and insufficient maintenance, the disconnection between heritage conservation work and daily social life also accelerates negative-space deterioration. Current conservation work mostly focuses on material relic protection, while ignoring the reconstruction of historical usage scenarios.

2.4 Analysis of Demand Contradictions between Residents and Tourists

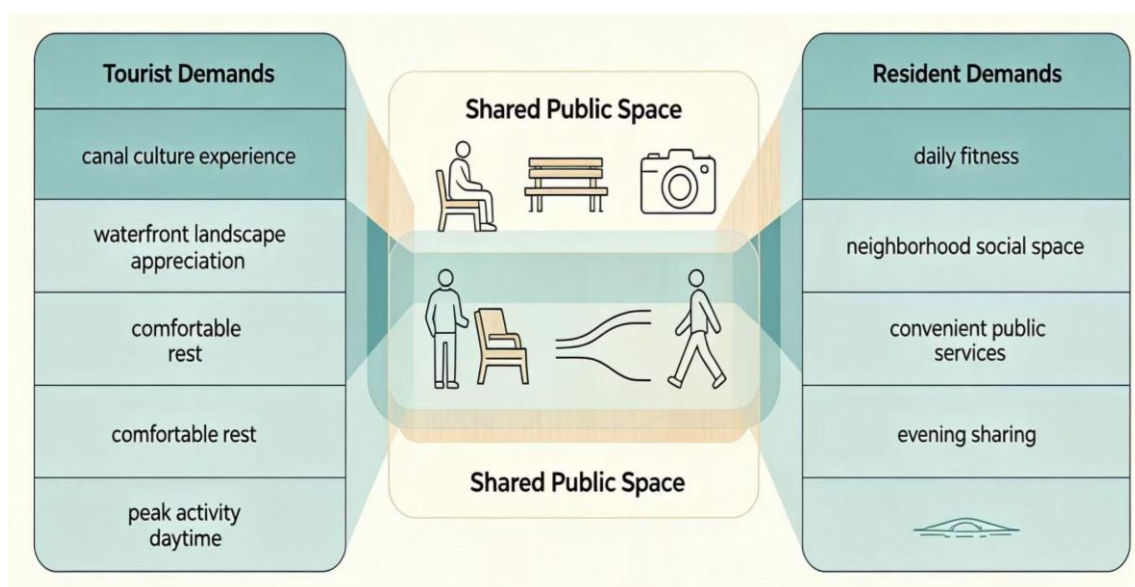


FIG 7 Demand comparison chart of residents and tourists

Based on questionnaires and interviews, demand portraits of two groups are formed. Tourists, mainly visitors aged 25-45, expect immersive canal-transportation cultural experience, attractive waterfront landscape, basic recreation infrastructure, and clear navigation signage. Their implicit need is to feel real historical everyday-life atmosphere rather than stylized decorative imitation.

Local permanent residents, dominated by inhabitants over 55 years old, need free public-activity territories within walking distance, sports equipment, recreation seating, community service points, and safe pedestrian paths. Their implicit fear is that renewal will take away public spaces for daily use, and they desire places for neighbourly communication and group activities.

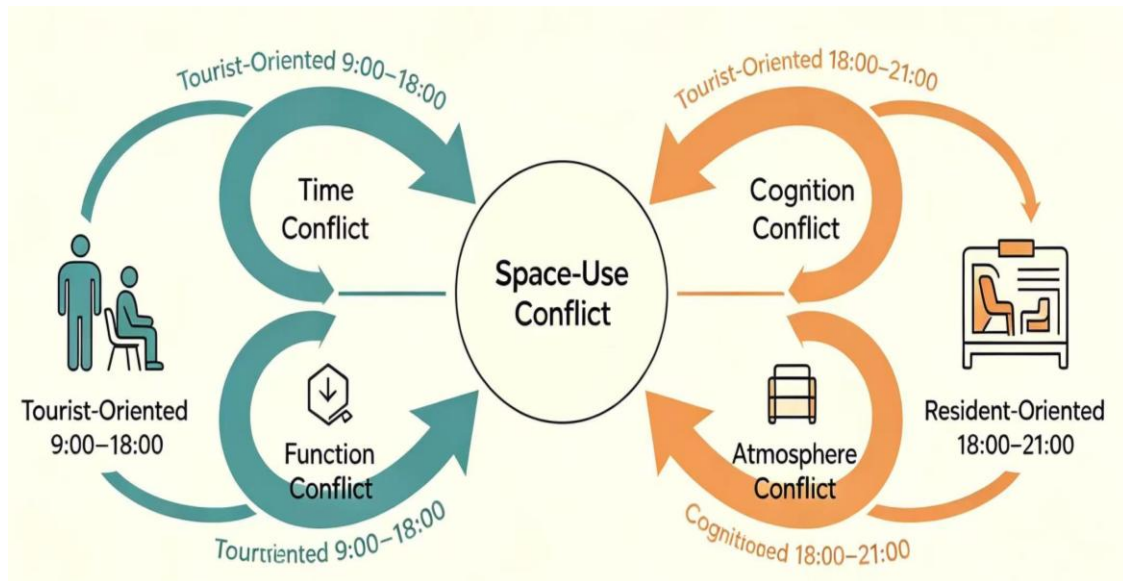


FIG8 Contradiction relationship schematic diagram

Four key contradictions are identified: time-related contradiction (tourists in daytime, residents in evening); functional contradiction (cultural exhibition vs community service); environmental-atmosphere contradiction (decorative refinement vs practical everyday adaptation); cultural-perception contradiction (tourist consumption object vs local collective memory).

Questionnaire surveys and semi-structured in-depth interviews further excavate explicit demands and implicit deep-seated demands of the two user groups, constructing complete user-demand portraits. Tourist groups are mainly composed of visitors aged 25-45 years old. Their explicit requirements include immersive canal-transport cultural experience, attractive waterfront landscape, comfortable rest facilities and clear navigation signage. Their implicit deep-seated demand is not superficial scenic sightseeing, but perceiving authentic daily historical atmosphere of Jianghuai canal town. Tourists expect to touch real local history rather than appreciate stylized fake-historical stage-set scenery.

Local permanent resident groups are dominated by elderly inhabitants over 55 years old. Their explicit demands contain walkable public-activity venues, fitness equipment, leisure seating and convenient community service points. Their implicit fear is that large-scale tourism-oriented renewal will occupy original daily public space for local people. Residents long for safe, nearby neighbourhood social places for square dancing, chess-playing and casual chatting.

Based on demand-portrait sorting, four core contradictions are summarized: time conflict between daytime tourist activities and evening resident activities; functional conflict between cultural-exhibition-oriented tourism requirement and community-service-oriented living requirement; environmental-atmosphere conflict between refined ornamental scenic atmosphere and practical daily-life atmosphere; cultural-cognition conflict: tourists regard space as consumption-oriented heritage landscape, while residents regard it as collective-memory-oriented homeland. These four contradictions interweave and mutually influence each other, which constitute the core difficulty of negative-space optimization in Yuncao Ancient Town. Any renewal scheme should avoid unilaterally sacrificing benefits of one social group for another.

Chapter 2 Conclusion

Chapter 2 reveals the theoretical adaptability of symbiosis concept along three dimensions, analyses historical background and real-state of the waterfront-wharf site, classifies negative-space types and their formative causes, and forms demand portraits of residents and tourists with four key contradictions. The materials create an empirical base for building optimization strategies in Chapter 3.

Chapter 3

Symbiotic Optimization Strategies and Design Project

3.1 Design Idea and Three-Dimensional Symbiosis Framework

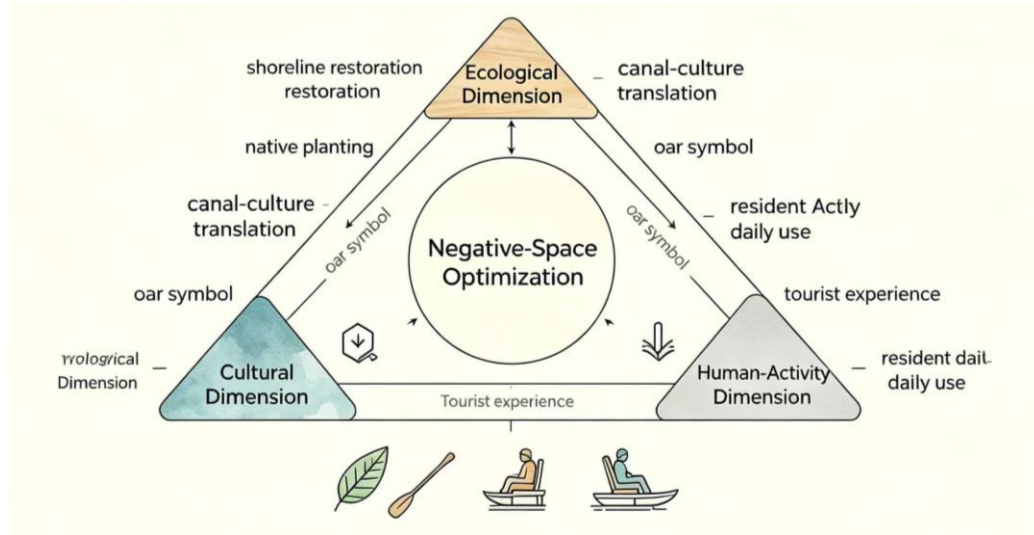


FIG 9 Three-dimensional symbiosis theoretical framework diagram

The main design idea is to implement micro-renewal low-intervention revitalization of the waterfront-wharf negative-space territory based on the three-dimensional symbiosis framework, achieving human-human symbiosis, space-human symbiosis, and space-culture symbiosis. Large-scale demolition is excluded; historical-heritage objects of the wharf are preserved to maximum extent; a low-cost multifunctional public territory is created, combining cultural-exhibition, waterfront-recreation and shared-activity functions.

The three-dimensional framework consists of: human-human symbiosis dimension (time-sharing use, special-purpose and shared territory zoning, joint-event programming); space-human symbiosis dimension (classified function adaptation, flexible modular facilities, accessibility improvement); space-culture symbiosis dimension (cultural symbol extraction, abstract re-interpretation, historical scene reconstruction). The three dimensions mutually support each other: human-human symbiosis is the ultimate goal, space-human symbiosis forms the material base, space-culture symbiosis is the ideological core.

3.2 System of Optimization Strategies

Strategy 1 (human-human symbiosis): time-sharing-use strategy. Daytime period (9:00-17:30, weekends/holidays) prioritizes tourists: cultural-exhibition belt fully opens, movable

exhibition stands unfold, souvenir stalls operate. Evening period (17:30-21:00) prioritizes residents: exhibition stands stowed, open space released for group-dance and neighbourly communication, soft night lighting applied without disturbing adjacent residential buildings.

Zoning strategy: tourist-special-purpose zone (cultural-exhibition belt) relying on preserved wharf stone-step relics; resident-special-purpose zone (small community-recreation node) near residential buildings with drinking-water points and simple sports equipment; central shared-activity belt with open lawn and movable market modules, fully shared by both groups.

Strategy 2 (space-human symbiosis): classified function adaptation. Function-deficit wharf implants composite functions of cultural exhibition, waterfront recreation and shared activity. Poor-environment bank undergoes environmental renovation with weed clearing, damaged revetment repair, native water-plant replanting. Cultural-loss wharf implants canal-transportation narrative system through ground carvings, pergola display racks and sculptures.

Flexible modular-facility strategy: movable cultural display racks, foldable leisure seating, detachable temporary market stalls, all switchable rapidly between tourist daytime mode and resident evening mode. Accessibility-optimization strategy: renovate pedestrian roads, repair bluestone pavement, reconnect broken lane segments, set up clear signage guidance, realize barrier-free passage for elderly people.

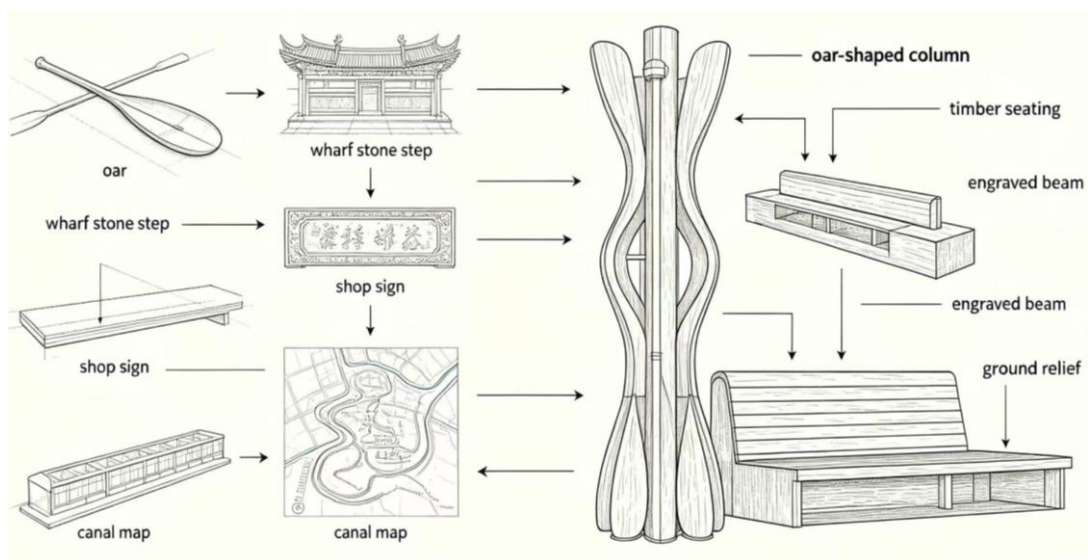


FIG 10 Cultural symbol extraction and translation diagram

Strategy 3 (space-culture symbiosis): abstract translation of canal-transportation cultural symbols. Local prototypes are extracted: wharf stone steps, oars, historic merchant names

(Yufeng Firm, Tongxing Firm), canal shipping route maps, cargo-loading labour scenes. Instead of simple pattern printing, oar motif is transformed into pergola column shape and landscape lamp modelling; merchant names are carved on pergola cross-beams; shipping route map becomes shallow-relief ground carving; loading labour scene becomes minimalist interactive sculpture.

The whole strategy system originates from the three-dimensional symbiosis theoretical framework and responds precisely to negative-space characteristics and user-group contradictions concluded in Chapter 2. For human-human symbiosis dimension, besides time-sharing-use and zoning strategy, demand-guiding and joint-event-planning measures are supplemented. Clear temporal-hint signage is set up inside public territory to inform visitors of time-switching rules of shared space. Regular joint events such as canal-transportation cultural fairs can be held monthly. During the fair, local residents sell handmade crafts and native agricultural products, while tourists participate in canal-related interactive games. Such joint-event mode promotes face-to-face communication between residents and tourists, easing potential spatial-use conflicts from the social-interaction level.

For space-human symbiosis dimension, classified function adaptation, flexible modular facilities and accessibility improvement form a complete technical path. For function-deficit negative-space such as abandoned wharves, compound functions of cultural exhibition and waterfront recreation are implanted. For poor-environment negative-space including deteriorated waterfront banks and blocked back-alley segments, the measures contain weed clearance, revetment repairing, pavement renovation and broken-lane reconnection. For cultural-loss negative-space, canal-transport narrative system is implanted through ground relief, pergola display racks and interactive sculptures. All movable stalls, display racks and folding seats adopt unified modular dimension specifications. Modular components can be prefabricated in factory, convenient for transportation and on-site assembly. Damaged individual module can be replaced separately without demolishing the whole landscape structure. Modules can also be recombined to generate diverse spatial layouts for festivals, market days and daily leisure scenarios. This modular technical feature perfectly matches low-intervention micro-renewal philosophy.

For space-culture symbiosis dimension, this thesis establishes a complete technical path of “cultural-symbol extraction-abstract reinterpretation-historical-scene reconstruction”. Typical local cultural prototypes are abstracted: wharf stone steps, oars, historical merchant

shop signs (Yufeng Firm, Tongxing Firm), canal shipping route maps and cargo-loading labour scenarios. Instead of simply printing graphic patterns on walls, cultural elements are transformed into tangible spatial components. Oar motif is translated into pergola columns and landscape-lamp modelling; ancient merchant firm names are carved on cross-beams of wooden pergola; canal shipping route map is transferred into ground shallow relief; cargo-loading labour scenes are condensed into minimalist interactive sculptures. Historical-scene reconstruction does not mean complete antique replica. It aims to rebuild behavioural scenarios related to canal-transportation history. Visitors and local residents can perceive cultural connotations in the process of using space, realizing the effect of “culture inheritance through daily space-using behaviour”. Material and plant selection strictly adhere to local-characteristic principles, preferring native timber, bluestone, grey brick and indigenous riparian vegetation, avoiding high-maintenance exotic ornamental species.

3.3 Practical Design for Waterfront Wharf Site

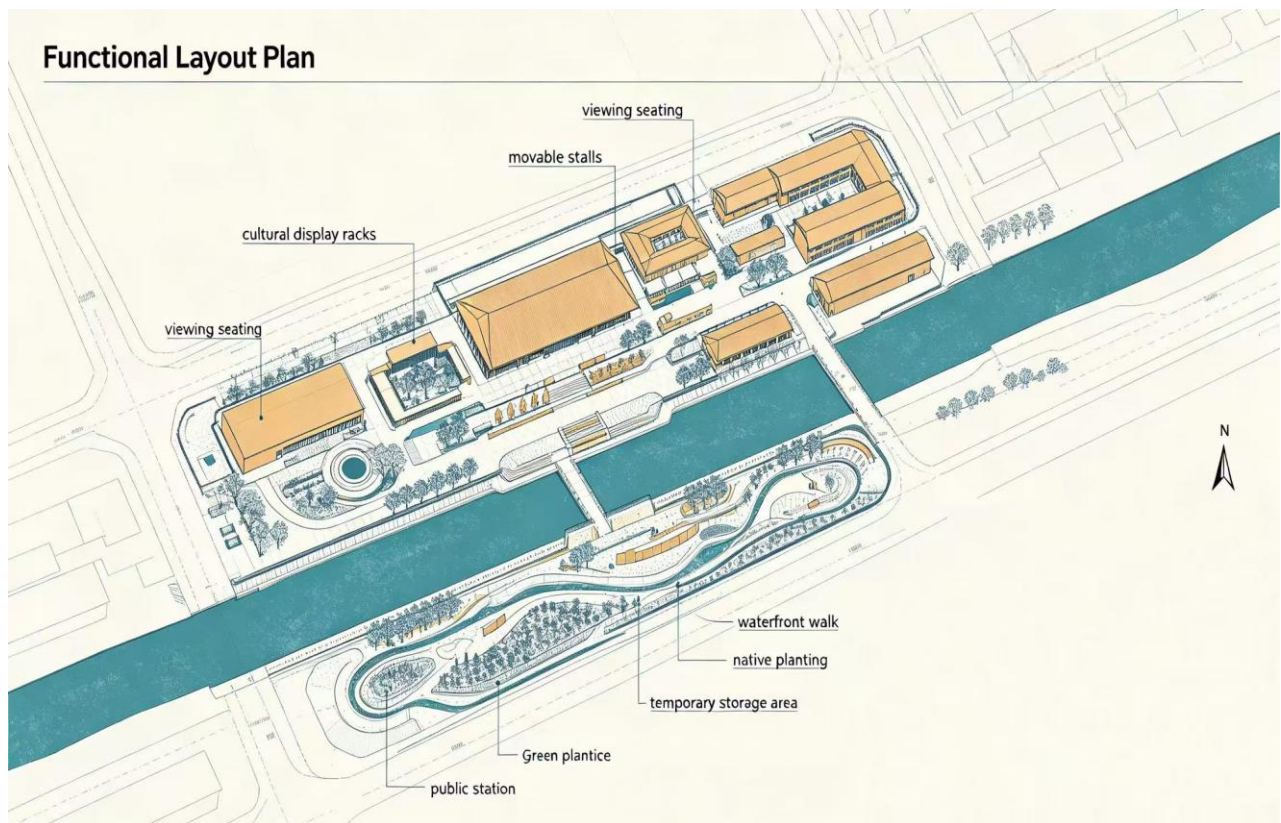


FIG 11 Master plan of waterfront wharf renewal project

The design site is the 2000 m² waterfront canal-wharf zone, selected because it represents composite function-deficit plus cultural-loss negative space, is adjacent to both tourist routes and residential neighbourhoods, and has moderate scale suitable for micro-

renewal. The overall layout follows "Three Belts and One Core" structure: cultural-exhibition belt (600 m², northern wharf area), waterfront-recreation belt (800 m², southern riverside), shared-activity belt (600 m², central area).

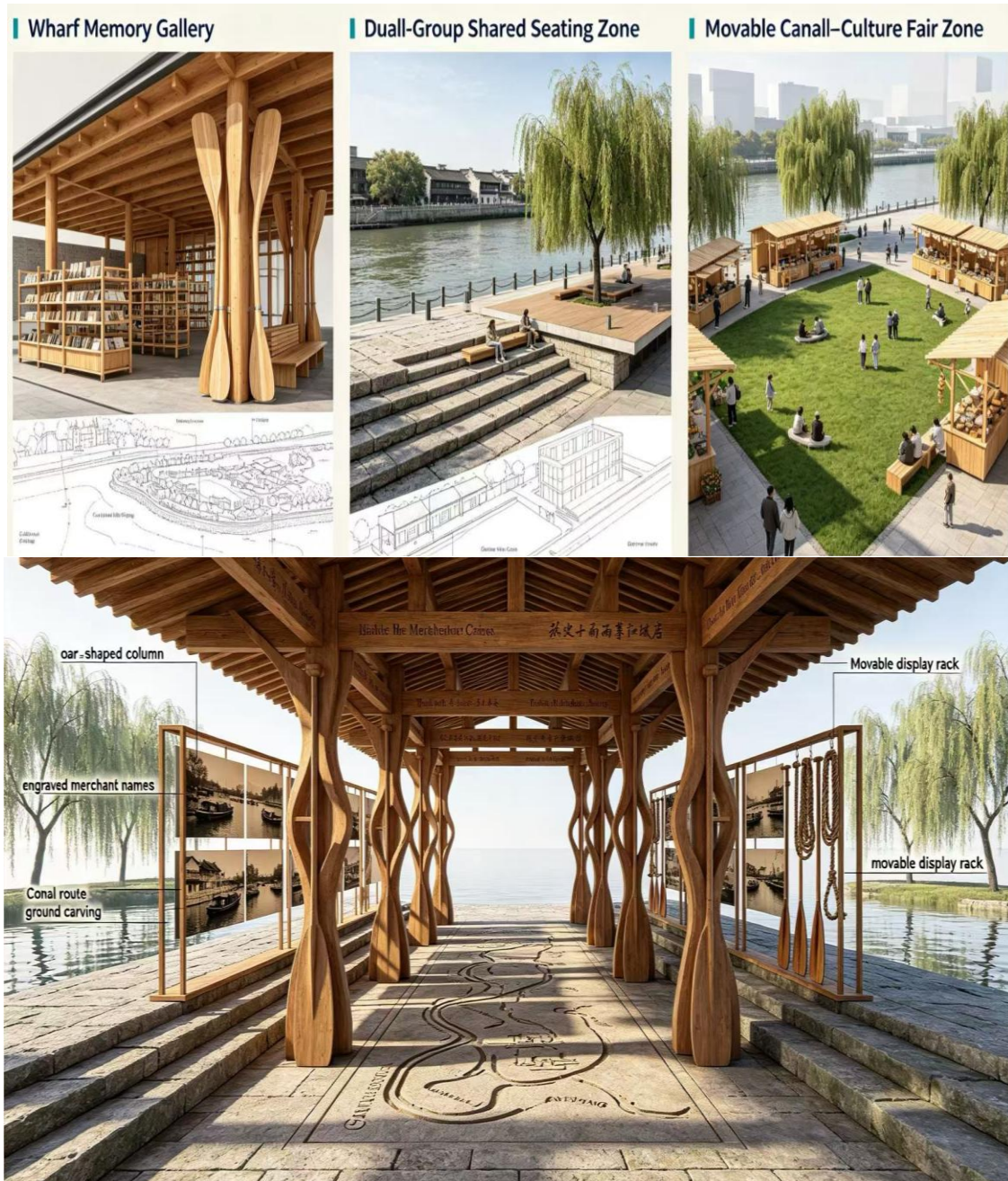


FIG 12 Perspective render of wharf-memory pergola

Key nodes: wharf-memory pergola (core of cultural-exhibition belt, with oar-shaped columns, merchant-name carved cross-beams, movable display racks of old photographs and replica canal-transportation tools); dual-group shared seating zone (one side facing river for tourists, one side facing residential blocks for residents, reconstructed from original wharf

stone steps); temporary market zone (ten movable stalls serving cultural souvenirs in daytime and local agricultural products in evening).



FIG 13 Material-plant selection schematic diagram

Material and plant selection: blue-brick pavement, log-wood pergola and seating, local natural stone for preserved wharf steps. Vegetation: weeping willow for waterfront, Chinese tallow tree for cultural-exhibition belt, crape myrtle shrubs in shared-activity belt, reeds along riverbank for ecological restoration. Colour system: blue-grey pavement, log-wood tone, ochre display-rack components, excluding bright modern colours.

The 2000 m² waterfront wharf design site belongs to composite negative-space integrating function-deficit attribute and cultural-loss attribute. It is adjacent both to tourist circulation routes and resident residential blocks, which makes it a representative sample for symbiosis-oriented micro-renewal. The overall layout follows the “Three Belts and One Core” structural logic: cultural-exhibition belt (600 m², northern wharf zone), waterfront-recreation belt (800 m², southern riverside zone), shared-activity belt (600 m², central zone).

The wharf-memory pergola is the core node of cultural-exhibition belt. Its structural columns adopt abstract oar-shaped modelling; cross-beams are engraved with historical merchant-firm names inherited from Yuncao ancient commercial history. Movable display racks are arranged under the pergola for exhibiting old historical photographs, replica canal-transportation tools and local-history documents. The ground inside the pergola is

paved with shallow-relief carving of canal shipping routes, visualizing the historical water-borne trade trajectory of Yuncao Town.

The dual-group shared-seating zone locates in the waterfront-recreation belt. It is reconstructed based on original preserved wharf stone-step relics. One side opens towards the canal river for tourists to appreciate waterfront scenery; the other side faces local residential quarters for residents to carry out casual rest and neighbourly communication.

The movable canal-culture fair zone lies in shared-activity belt, equipped with ten detachable modular stalls. In daytime (9:00-17:30), stalls unfold for selling canal-transport-themed cultural souvenirs for tourist visitors. In evening period (17:30-21:00), these stalls can be reused for local residents to sell home-grown agricultural products and handmade articles. Central open lawn provides flexible event space for group dancing, community gathering and temporary folk-custom performances.

Material application strictly follows local-texture and low-intervention principle. Original historical wharf stone steps are retained and reused as much as possible. Bluestone and grey brick constitute main pavement system. Weather-resistant local timber is applied for pergola framework and leisure-seating components, with surface anti-corrosive treatment to reduce later-stage maintenance pressure. For waterfront revetment construction, partial original stone revetment heritage is completely preserved; newly-added revetment segments adopt dry-stack stonework instead of full concrete pouring. Dry-laying stone structure maintains water-soil permeability, creates micro-habitat for aquatic organisms, and keeps visual continuity with historical wharf masonry texture.

Hierarchical vegetation configuration is implemented for the whole site. Riparian reed buffer zone is arranged along canal water surface to realize ecological transition between artificial site and river ecosystem. Large-size weeping willow trees are planted in waterfront recreation zone for summer shading. Grape-myrtle shrubs and native herbaceous plants are collocated inside shared-activity open lawn. The whole plant community gives priority to indigenous species with low maintenance cost, avoiding exotic ornamental horticulture plants. The overall colour palette of the design is dominated by bluestone-grey, log-wood natural tone and ochre decorative components; glaring high-saturation modern colours are forbidden.

Furthermore, progressive phased-construction thinking is embedded within this schematic design. Core priority phase-one construction objects include wharf-memory

pergola, dual-group shared-seating zone and key revetment restoration work. Secondary landscape elements such as partial plant-buffer belts and supplementary market-module facilities can be implemented in phase two according to actual financial budget. Pre-buried circuit and water-supply pipelines are reserved inside site territory, reserving adjustment margin for future adding new public-service installations without large-scale ground breaking. Corresponding long-term operation suggestions are put forward: movable-facility storage, daily cleaning and regular-event organization can be jointly managed by town-administrative department and resident volunteer groups, guaranteeing sustainable vitality after completion.

3.4 Feasibility Assessment

The project is feasible from multiple dimensions: cultural-heritage support (Yuncao as national historical-cultural town with rich canal-transportation heritage); theoretical feasibility (symbiotic-city theory, negative-space classification theory, canal-transportation cultural research all provide solid foundation); inter-disciplinary support (integrating human-settlement science, visitor-experience theory, community-participation theory); investigation feasibility (1.2 km² moderate area, convenient traffic, two preliminary field investigations completed); policy feasibility (consistent with national cultural-tourism and rural-revitalization policies, micro-renewal low-cost approach conforming to local economic level); dual-group-demand compatibility (balancing tourist and resident needs, high social acceptance).

Apart from cultural-heritage support, theoretical foundation, interdisciplinary support, field-investigation convenience, policy compliance and social acceptance mentioned above, phased-construction mode further enhances project economic feasibility. Instead of requiring one-time full investment, core nodes can be constructed preferentially according to limited funding conditions.

Potential risks in implementation process should not be ignored. First, modular movable facilities demand special-purpose storage space and regular daily management mechanism. Second, residents' acceptance degree towards renewed public space needs continuous observation after completion. Third, fund fluctuation may influence material-selection standards and construction scale.

Targeted countermeasures are proposed correspondingly. Joint-management mechanism combining government administration and resident volunteer groups can solve

daily-management problems of movable facilities. Pre-construction public consultation activities shall be held to collect local inhabitants' suggestions in advance, enhancing public-recognition degree of the whole scheme. The phased-implementation design strategy can adapt to fund fluctuation. Besides, reserved pipeline and foundation positions allow flexible function adjustment in long-term operation stage. These countermeasures reduce practical-implementation obstacles for the symbiosis-oriented micro-renewal scheme of Yuncao waterfront wharf negative-space.

Chapter 3 Conclusion



FIG 14 Overall bird-eye-view render of renewed wharf site



FIG 15 Site renderings of different time periods

Chapter 3 puts forward core design concept and complete three-dimensional symbiosis framework, establishes systematic optimization strategies along three dimensions, completes full design practice for the 2000 m² waterfront wharf site including layout, zoning, node design, material-plant control, and conducts multi-dimensional feasibility analysis.

GENERAL CONCLUSION

1. Yuncao Ancient Town, as a typical Jianghuai canal-transportation historical town, generates three categories of negative space: function-deficit, poor-environment, cultural-loss. Root causes include decline of canal-shipping, misguided renewal concepts, unbalanced cultural-tourism development, static heritage preservation, and lack of long-term maintenance. Negative spaces break historical fabric continuity and create prominent conflicts between tourists and residents.

2. This thesis constructs a three-dimensional symbiosis theoretical framework: human-human symbiosis (win-win coexistence through time-sharing, zoning, joint events), space-human symbiosis (matching spatial functions with real user demands through classified adaptation, flexible facilities, accessibility improvement), space-culture symbiosis (organic integration of canal-transportation culture through symbol translation, scene recreation, style control, avoiding superficial symbol stacking).

3. Taking the 2000 m² waterfront canal-wharf negative space as practical site, the thesis completes micro-renewal design of "Three Belts and One Core" layout, adopting movable modular facilities, time-sharing rules, canal-transportation symbol translation and local materials. The abandoned idle wharf is transformed into composite public space integrating cultural exhibition, waterfront recreation and shared activity, following low-intervention principle with low cost and high feasibility.

4. This research summarizes a replicable practical paradigm for negative-space optimization of canal-transportation historical ancient towns, realizing coordinated development of spatial revitalization, regional cultural inheritance and resident-tourist win-win. It provides reference for similar canal-transportation towns in China, promoting living-heritage conservation, high-quality cultural-tourism development and rural revitalization.

5. In terms of specific design elements, the project adopts timber as the core material. Wood is selected for its natural texture, low environmental impact and deep local cultural connotation, which echoes the traditional wooden buildings and water transportation culture of Yuncao Ancient Town. Meanwhile, the oar is taken as the symbolic design form. As a typical carrier of the town's waterborne history, the oar element builds an associative bridge between the historical memory of the ancient canal and modern landscape space. These two

design elements jointly realize the goal of activating the negative space of the ancient town while inheriting local heritage.

While this research constructs a targeted three-dimensional symbiosis optimization framework and completes schematic micro-renewal design for the typical waterfront wharf negative-space in Yuncao Ancient Town, it still has several inherent limitations constrained by objective research conditions. First of all, the sample scale of questionnaire and semi-structured interview investigation is limited by the time-cost and field-access conditions of this master qualification work. Although respondents cover local elderly residents, ordinary tourists and administrative-management personnel, the total quantity of valid samples cannot realize large-scale full-coverage sampling across the whole 1.2 km² historic core zone. User-demand portraits and conflict-analysis results can reflect mainstream characteristics, yet individual special-case demands cannot be fully reflected. Further large-volume social surveys could collect more diversified feedback for optimizing design details.

Secondly, the design output of this thesis remains at the schematic-design stage. The whole set of renewal scheme has not gone through real-world construction, so actual site-using effects, long-term operation conditions and real-world feedback from residents and tourists cannot be verified. Factors such as on-site geological condition, actual fund input and later-stage management mode may bring adjustments to node size, material selection and module combination.

Thirdly, this paper focuses research depth on the waterfront-wharf composite negative-space as the core practice object. Nevertheless, Yuncao Ancient Town possesses large quantities of other negative-space resources including disconnected back-street lanes and dilapidated historical courtyards. Corresponding targeted renewal strategies for these two categories of negative-spaces are only briefly mentioned in theoretical-analysis chapters, without carrying out complete matching design practice. There is still room for further expansion of research scope.

Based on the above-mentioned limitations, several directions can be put forward for follow-up related research. If conditions permit, post-occupancy-evaluation research can be carried out after the implementation of similar symbiosis-oriented micro-renewal projects. Through multi-period on-site observation, repeated questionnaires and user-interview work, researchers can test the practical effect of the three-dimensional symbiosis theoretical

framework, revise strategic details according to real-world user-feedback, and continuously improve the adaptability of the whole theoretical-system.

Moreover, comparative-study can be expanded among multiple Jianghuai canal-transportation ancient towns. By selecting several similar settlement cases with different population-size and economic-development levels, researchers can distinguish between universal optimization rules suitable for most canal-transportation ancient-town negative-spaces and personalized countermeasures formed according to each town's unique cultural genes and spatial texture. Such work will further promote the generalization and popularization of the research-paradigm proposed in this paper.

Finally, more attention can be paid to community-participation mechanism research in the whole renewal process. How to effectively absorb local residents' suggestions in early-stage scheme formulation, construction-period supervision and post-completion daily-management links is an important guarantee for realizing long-term sustainable vitality of ancient-town public-space, which deserves deeper exploration in subsequent studies. It is expected that this thesis can provide beneficial reference for living-heritage conservation and micro-regeneration of Chinese canal-related historical settlements.

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