

Integrated practice of physical examination and renewal of historical and cultural blocks: a case study of the Shanyin Road Historic Area in Shanghai

Yu Pan^{}, Han Zou*

Green Energy-Saving and Low-Carbon Innovation Institute, Shanghai Research Institute of Building Sciences Co., Ltd., Shanghai, China

*Corresponding Author. Email: panyu@sribs.com

Abstract. Urban physical examination is an important foundational institutional instrument for advancing urban renewal actions and achieving high-quality urban development. At present, urban physical examination practices mainly focus on comprehensive evaluations at the macro district scale, and there is a lack of systematic, specialized physical examination practices for special areas such as historical and cultural conservation areas that entail both conservation requirements and renewal demands. Taking the Shanyin Road Historical and Cultural Conservation Area in Shanghai as the research subject, this paper conducts a specialized renewal physical examination across four dimensions—historical and cultural resources, commercial business vitality, neighborhood spatial quality, and inefficient idle resources. By comprehensively applying multi-source data fusion methods including spatial analysis, field surveys, and questionnaire surveys, it systematically identifies key issues in the conservation area regarding the preservation and repair of historic buildings, optimization of business structures, improvement of neighborhood quality, and activation of idle spaces. Based on the physical examination results, differentiated renewal strategies are proposed for the four main streets—Sichuan North Road, Shanyin Road, Duolun Road, and Tian'ai Road—to explore a refined renewal path of "physical examination first, renewal second." The research results can provide practical references for the integrated physical-examination-and-renewal of Shanghai and similar historical conservation areas.

Keywords: urban physical examination, historical and cultural blocks, integrated physical-examination-and-renewal, street-specific strategy, Shanyin Road Historic Area

1. Introduction

Urban physical examination is a systematic undertaking that comprehensively evaluates the status of urban development and construction, formulates targeted countermeasures, optimizes urban development goals, addresses shortcomings in urban construction, and resolves the problems of "urban diseases." It serves as an important lever for implementing urban renewal actions, coordinating urban planning, construction, and management, and promoting the high-quality development of the urban living environment. Since the 13th

Five-Year Plan, China's urban physical examination has gone through three stages—pilot exploration, comprehensive deepening, and integrated advancement—and has gradually established the basic principle of "physical examination first, renewal second; no physical examination, no renewal," with the integrated linkage mechanism between urban physical examination and urban renewal becoming increasingly mature. Against this backdrop, Shanghai has progressively established a four-tier urban physical examination system—city, district, subdistrict/town, and community—adapted to the characteristics of a megacity. In September 2025, the Shanghai Municipal Housing, Urban-Rural Development and Management Commission issued the Working Guidelines for Promoting Urban Renewal through Urban Physical Examination (Shanghai Housing and Urban-Rural Development Comprehensive Planning [2025] No. 449), emphasizing problem-oriented, goal-oriented, and value-oriented approaches, strengthening the application of outcomes, and giving full play to the supporting role of urban physical examination in urban renewal actions, so as to advance the integrated promotion of urban physical examination and urban renewal. As a pioneer city in the integrated advancement of urban physical examination and urban renewal nationwide, Shanghai's practice of specialized renewal physical examination in historical and cultural conservation areas is of exemplary significance.

In essence, urban physical examination is a problem-oriented, multi-dimensional urban diagnostic method aimed at identifying structural contradictions in urban development and shortcomings in spatial governance through systematic indicator evaluation [1, 2]. Relevant scholars have carried out extensive exploration in indicator system construction and spatialization analysis methods: Zhao et al. reviewed the development context of physical examination and evaluation from the perspective of the public policy process [3]; Wu et al. discussed the practical challenges of physical examination in megacities using Shanghai as an example [4]; Cui and Long et al. achieved refined spatial evaluation by leveraging big data and GIS technologies [5, 6]. At present, urban physical examination practices mainly revolve around the four spatial levels of "housing—community (residential)—block—urban district" defined by the Ministry of Housing and Urban-Rural Development [7], yet most focus on universal indicator evaluation at the macro urban-district scale. Zhang and He pointed out that historical urban areas receive insufficient attention in the existing physical examination system and called for the construction of a specialized evaluation system [8]; Cui and Shi proposed a digital diagnosis method for historical districts from a three-dimensional "time-space-society" perspective [9]. The above studies have not yet completed the full-process closed loop of "physical-examination diagnosis—problem identification—renewal connection" at the scale of historical and cultural conservation areas.

Therefore, taking the Shanyin Road Historical and Cultural Conservation Area in Shanghai as the research subject, this paper conducts a specialized renewal physical examination oriented to historical conservation areas, explores an integrated technical path of physical examination and renewal suited to historical and cultural conservation blocks, and identifies practical problems in conservation protection, living environment, and functional development, so as to provide theoretical support and practical reference for the refined renewal of historical and cultural conservation areas.

2. Research content

2.1. Study area

The Shanyin Road Historical and Cultural Conservation Area is located in the jurisdiction of Sichuan North Road Subdistrict, Hongkou District, Shanghai, with a total area of 129 hectares, and is one of the conservation areas in Shanghai's central urban area with a relatively large number and scale of outstanding historic buildings. This study focuses on the core area bounded by Sichuan North Road–Tian'ai Branch Road–Sida Road–Bao'an Road–Wuhua Road–Siping Road–Xingjiaqiao North Road–Changchun Branch Road–Hailun

West Road–Baoshan Road–Dongjiangwan Road, covering a total area of 71.76 hectares. The Shanyin Road Conservation Area took shape in the first half of the 20th century and preserves a large number of historical buildings of various types, including Shikumen lanes, new-style lanes, and garden houses. With intact street fabric and diverse architectural styles, it is renowned as an "open-air museum" of Shanghai-style residential architecture. The area also nurtures abundant red cultural resources and celebrity imprints, serving as an important carrier of Shanghai's urban memory and cultural context.

At present, the core contradictions facing this conservation area lie in the following aspects: most of the historic buildings have reached a century in age, and some have suffered stylistic damage and functional decline due to prolonged use; the district's commercial businesses are homogeneous and lacking in vitality, disconnected from the integration of surrounding functions; and the residential population is highly aged, with shortcomings in the supply of public service facilities. The interweaving and compounding of the above problems makes the renewal challenges of the Shanyin Road Conservation Area a typical microcosm of the conservation and renewal of historical conservation areas in Shanghai and even in megacities across the country. Based on the above analysis, this study, under the premise of protecting the historical and cultural character, uses specialized physical examination to identify the practical difficulties of the area in functional renewal, cultural activation, spatial environment improvement, and activation of existing resources, and then proposes localized renewal strategies to support the area's refined renewal actions.

2.2. Research approach

To accurately identify the current status and problems of the Shanyin Road historical conservation core area, and to coordinate the four core demands of conservation protection, functional development, livable livelihood, and resource activation, a four-dimensional quantifiable indicator system for specialized renewal physical examination is constructed, as shown in Table 1. The historical and cultural resources dimension focuses on the preservation of protected buildings and the effectiveness of red-resource activation; the commercial business vitality dimension examines business structure, pedestrian flow vitality, and supply–demand matching; the neighborhood spatial quality dimension systematically evaluates transport accessibility, parking, greenery, and the livability of the slow-traffic system; and the inefficient idle resources dimension classifies and surveys the vacancy status and renovation potential of existing spaces.

Based on the indicator system framework, multi-source data are integrated to conduct quantitative and visualized assessment, producing three thematic maps—problem map, resource map, and demand map—that intuitively present the characteristics of concentrated shortcomings, the distribution of existing potential, and the spatial differences in residents' demands. Through the overlay and coupling analysis of the three maps, the core problems of the area are summarized, and priority remediation zones and key activation carriers are delineated. Combined with the differentiated endowments of the four streets—Sichuan North Road, Duolun Road, Shanyin Road, and Tian'ai Road—a "street-specific strategy" renewal plan is formulated, forming an integrated renewal physical-examination technical path of "indicator construction—multi-source evaluation—spatial diagnosis—strategy output" for the Shanyin Road Historical Conservation Area.

Table 1. Specialized renewal physical examination indicator system for the Shanyin Road Conservation Area

Indicator Dimension	No.	Indicator Name	Indicator Definition
Historical and Cultural Resources	1	Rate of Designated Historic Buildings	Number of intact designated outstanding historic buildings / total number
	2	Conservation and Repair Rate of Historic Buildings	Proportion of historic buildings that have undergone repair and renovation to the total
	3	Architectural Style Compliance Rate	Proportion of historic buildings free from illegal demolition/alteration and unauthorized construction
	4	Activation Rate of Red Cultural Resources	Number of identified and archived red heritage sites / total sites
	5	Coverage Rate of Public Cultural Facilities	Proportion of residential land covered by public cultural facilities within 300 m to total residential land
	6	Accessibility of Public Cultural Facilities	Proportion of area covered by public cultural facilities within a 5-minute walking distance to total area
Commercial Business Vitality	7	Proportion of Catering Businesses	Proportion of catering shops among sampled shops to total sampled shops
	8	Proportion of Retail Businesses	Proportion of retail shops among sampled shops to total sampled shops
	9	Average Daily Pedestrian Flow in Peak Hours	Average pedestrian flow in core blocks during peak hours
	10	Proportion of Middle-aged and Elderly Customers	Proportion of shops serving middle-aged and elderly customers among sampled shops to total sampled shops
	11	Merchant Operating Satisfaction	Proportion of merchants satisfied with the block's operating environment among sampled merchants
Neighborhood Spatial Quality	12	Public Transport Accessibility	Proportion of area covered by metro and bus stations within a 5-minute walking distance to total area
	13	Number of Roads with Continuous Surface Damage	Number of roads with continuous surface damage (length exceeding 50 m)
	14	Parking Lot Coverage Rate	Proportion of area covered by parking lots within 300 m to total area
	15	Traffic Congestion Index	A composite indicator of road network traffic efficiency in the block during peak hours, expressed as the ratio of actual travel time to ideal travel time; < 80 indicates smooth flow, 80–100 basically smooth, 100–120 mildly congested
	16	Proportion of Roads with High Non-motorized Vehicle Parking Demand	Proportion of roads with high non-motorized vehicle parking demand to total roads
	17	Neighborhood Green View Index	The proportion of green vegetation (trees, grass, shrubs, etc.) visible to pedestrians in the block within their entire field of view

Table 1. Continued

Inefficient Idle Resources	18	Total Floor Area of Inefficient Idle Resources	Total floor area of inefficient idle resources
	19	Proportion of Functionally Inefficient Resources	Proportion of spaces with an average annual vacancy rate $\geq 30\%$ to total idle resources
	20	Incidence Rate of Safety Hazards in Idle Resources	Proportion of idle resources with safety problems such as structural damage and missing fire protection

2.3. Research methods

In terms of data collection, the data come from four types of sources: (1) basic geographic and spatial data, including building footprints, road networks, lists of protected historic buildings, and red cultural sites, provided by relevant departments and subdistrict offices; (2) POI data of commercial facilities and road traffic data during peak hours, obtained through internet map platforms, used for business-distribution and traffic-congestion analysis, while the neighborhood green view index is calculated based on street-view image data; (3) questionnaire surveys of permanent residents and street-front merchants in the conservation area, covering residential satisfaction, facility demand, business conditions, and development appeals, obtained through a combination of offline household visits and door-to-door street surveys; and (4) contents such as municipal roads, idle spaces, and the preservation status of historic buildings, obtained through comprehensive and in-depth field surveys and verification.

In terms of spatial analysis, with the aid of a Geographic Information System (GIS) platform, buffer analysis is used to evaluate the coverage of public transport and public cultural facilities, kernel density analysis is used to identify commercial agglomeration hotspots, and spatial overlay clustering analysis is used to form the problem map, resource map, and demand map.

In terms of problem diagnosis and strategy formulation, the results of spatial analysis, questionnaire surveys, and field surveys are cross-validated in three ways to improve the accuracy of problem diagnosis; based on the functional positioning of each street and the characteristics of physical-examination problems, phased and categorized renewal countermeasures are proposed following the principle of "street-specific strategy."

3. Identification of physical examination problems

3.1. Historical and cultural resources

The analysis is conducted around the protection of historical conservation buildings, the stylistic characteristics of the block, and the utilization of cultural resources, so as to systematically identify the shortcomings of the Shanyin Road Conservation Area in building protection, stylistic continuity, and open sharing of cultural resources.

In terms of the protection of historical conservation buildings, the area currently has 103 historical conservation buildings, including 74 immovable cultural relics, 27 historically protected buildings, and 2 historic buildings, with a historic building density of 1.44 buildings per hectare, indicating a high concentration of conservation resources. In recent years, the area has continuously advanced protection and repair work, with a cumulative total of 34 historic buildings having undergone repair and renovation. The overall repair rate is about 33%; among them, 13 historically protected buildings have been repaired, a repair

rate of about 48%, while 20 immovable cultural relics have been repaired, a repair rate of about 27%, and the protection and repair of immovable cultural relics still needs to be strengthened.

In terms of the stylistic characteristics of the block, the Shanyin Road Conservation Area gathers various types of historical buildings—Shikumen lanes (e.g., Laohengfengli, Yuqingfang), new-style lanes (e.g., Dalu Xincun, Xinhengfengli), and garden houses (e.g., Songyun Villa, Liuqing Xiaozhu)—with a high degree of architectural stylistic integrity and historical fabric completeness, laying a good foundation for the overall protection of the conservation area, while also implying that renewal strategies need to adopt differentiated measures for different building types. Shikumen lanes such as Laohengfengli pay attention to the balance between the modernization of public space facilities and stylistic maintenance, naturally integrating lane-style layouts, flower-bed greenery, and public benches into the street fabric, making the buildings carriers of the street's everyday bustle. New-style lanes focus on the repair and protection of stylistic features such as red bricks and red tiles, adopting typical characteristics like red-brick red-tile facades, double-pitch roofs, and dormer windows to form a unique street experience. Garden houses need to protect the continuity of the skyline and the layout of courtyard greenery, with Spanish-style red-tile pitched roofs and soft facades achieving coordination between the overall townscape and the street skyline.

In terms of cultural resource supply, the Shanyin Road Conservation Area hosts a total of 41 time-honored brands, intangible cultural heritage inheritance sites, and cultural facilities, including 3 museums, 1 art gallery, 1 bookstore, 1 patriotic education base, 1 community parlor, 1 heritage site, and 33 residences, presenting the characteristics of dense and multi-tiered cultural resources. In terms of spatial coverage, public cultural facilities in the area achieve a 300-meter-radius coverage rate of 90% and a 5-minute walking accessibility coverage rate of 91%, basically meeting the service-radius requirement of walking accessibility for residents.

In terms of public cultural vitality, venues such as the 1927·Lu Xun and Uchiyama Memorial Bookstore, the Former Residence of Martyr Li Bai, the Shanghai Duolun Museum of Modern Art, and the Digital Parlor of Lu Xun's Book Storage Room can all rely on their own resource advantages to regularly plan and launch themed cultural exhibitions, reading salons, art workshops, and other activities, forming a relatively stable cultural output mechanism, and cooperate with schools, community organizations, and social groups, resulting in relatively sufficient overall public cultural vitality.

In terms of the utilization of red cultural resources, the resource activation rate of red cultural sites in the area reaches 100%, and some important nodes have been repaired and opened to the public. However, on the whole, the red cultural resources in the area still suffer from insufficient openness, low public accessibility, and weak perceptibility—for example, the Former Residence of Mao Dun and the Former Residence of Huang Jingwu are still used as residential living spaces, and constrained by building conditions and residential functions, they are not yet open to the public, making it difficult to effectively present their cultural value to the public. Overall, the historical and cultural resources of the Shanyin Road Conservation Area exhibit the structural characteristics of "abundant total volume, uneven activation, and restricted openness."

3.2. Commercial business vitality

Taking the conservation area as the core, this study focuses on the four main streets—Sichuan North Road, Shanyin Road, Duolun Road, and Tian'ai Road—and conducts an on-site census of 307 street-front shops and an in-depth sample survey of 63. The data show that catering and retail businesses account for relatively high proportions in the conservation area, at 38% and 45% respectively, with a traditional business mix. The four main streets show significant differences in dominant business types, shop distribution, and pedestrian flow vitality.

Sichuan North Road has a total of 145 street-front shops, with a business structure dominated by catering and retail, accounting for 54% and 39% respectively. This road section has superior location conditions and a good pedestrian flow foundation, but its businesses still mainly consist of traditional daily consumption; compared with the business structure of comparable commercial blocks in Shanghai, emerging experience-based formats are clearly insufficient, lacking new experience-oriented and fashionable formats targeting young customers, such as creative fusion dining, designer brand stores, trendy toys, and cultural-creative collection stores, which constrains the block's transformation and upgrading toward a modern and diversified commercial experience space.

Duolun Road currently has 64 street-front shops, with 30 service businesses (47%) and retail dominated by traditional cultural consumer goods such as antiques, calligraphy and paintings, and stationery, accounting for 41%. There are few shops with cultural-commercial characteristics along the street, such as Shanghai Bookstore and Gongfei Coffee, while visitor surveys show that tourists' demand for light catering, cultural-creative experiences, and interactive exhibitions reaches as high as 85%, indicating a structural supply-demand mismatch between the existing business structure and consumer demand.

Shanyin Road currently has 59 street-front shops, including 20 catering businesses (38%), 28 retail businesses (40%), and 11 basic livelihood service businesses such as convenience supermarkets, vegetable markets, barbershops, and repair shops, accounting for 22%. The existing businesses mainly consist of traditional daily consumption; considering that the proportion of permanent residents aged over 60 in this area is relatively high, there is a significant shortcoming in the supply of age-friendly services.

Tian'ai Road currently has 39 street-front shops, with 28 retail businesses (72%). As a well-known "love-themed block" in Shanghai, its current business structure severely lacks formats directly related to marriage, dating, and romantic consumption, showing an obvious disconnect from the block's positioning as a "love landmark," and failing to form a consumption scenario deeply integrated with romantic experiences.

In terms of pedestrian flow scale, Sichuan North Road ranks first in average daily flow, with marked differences between its northern and southern sections: the northern section has a maximum daily flow of about 3,600 person-times, while the southern section reaches as high as 18,000 person-times, indicating the stronger commercial attractiveness of the southern section. Duolun Road has a maximum daily flow of 3,750 person-times, but affected by the non-essential nature of its businesses and limited accessibility, its average daily flow is generally below 100 person-times, and its commercial vitality potential has not been fully released. Shanyin Road has a maximum daily flow of about 1,650 person-times, concentrated at the interchange node with Sichuan North Road. Tian'ai Road has a maximum daily flow of about 450 person-times, with few street-front commercial carriers and insufficient conversion efficiency.

Feedback from merchant surveys reveals two prominent problems in the conservation area: first, traffic travel and static traffic management issues that urgently need improvement—difficult parking in the block, low traffic efficiency on some roads, and disorderly non-motorized vehicle parking; second, insufficient commercial vitality and business structure that urgently need optimization—merchants generally report insufficient pedestrian flow and high operating pressure, and in some areas the local consumption base has weakened due to factors such as old-area renovation and population outflow. In addition, sample surveys show that middle-aged and elderly customers account for 88.4%, with a lack of youthful vitality and attractiveness; merchant operating satisfaction is only 34.8%, reflecting a large gap between the block's operating environment and business expectations, and most merchants believe that surrounding businesses are severely homogenized and lack differentiated competitiveness.

3.3. Neighborhood spatial quality

The current status of the block's traffic convenience, spatial environmental quality, and supporting carrying capacity is systematically reviewed to identify the main shortcomings and influencing factors in the construction of neighborhood quality space.

In terms of public transport accessibility, the area is rich in public transport resources and has high overall accessibility. Three metro stations—Hongkou Football Stadium Station, Dongbaoxing Road Station, and Hailun Road Station—have been built at the boundary and periphery of the conservation area, with another, Tian'ai Road Metro Station, under construction. Ten bus stops are distributed within the area, and a 5-minute walking circle can basically cover the main public transport stations, with the public transport accessibility indicator reaching 93.6%. There are 18 main roads in the area in total; according to field surveys and real-time traffic analysis from Baidu Maps, the overall traffic condition is good, with a traffic congestion index of 90, and most road sections remain basically smooth during peak hours, except for Liyang Road (eastbound–westbound), which experiences periodic slow-moving traffic during morning and evening peaks.

In terms of motor-vehicle parking and charging facilities, the area currently has 5 parking facilities with a 300-meter coverage rate of 87.6%, providing a total of 578 parking spaces. Except for the Baohua Commercial Plaza parking garage (245 spaces), which has relatively ample parking, the other parking lots are basically in a highly saturated operating state (occupancy rate > 95% during peak hours), and the parking resources in the area exhibit the dual characteristics of "insufficient total volume + structural tension." In terms of charging pile configuration, 66 charging berths are arranged with a coverage rate of 80%, indicating a generally high configuration level; however, the utilization rates of charging piles differ markedly among parking lots—the utilization rate at Hongkou Century Hotel exceeds 70%, while those at Jinhaian Commercial Building parking lot and Shanghai Fashion Commercial Building underground parking garage are below 20%—and the match between the layout of charging facilities in the area and residents' actual demand needs to be optimized.

In terms of the orderliness of non-motorized vehicle parking, the demand for non-motorized vehicle parking varies significantly across road sections in the conservation area, with roads having relatively high non-motorized parking demand accounting for 25%. The southern section of Sichuan North Road (Shanyin Road–Hailun West Road), due to dense shops, concentrated takeout demand, and large foot traffic, has the most prominent non-motorized parking demand and considerable parking-order pressure; the northern section of Sichuan North Road has marked parking spaces that basically meet parking demand, with good parking order. Duolun Road, constrained by road width, has no marked non-motorized parking spaces and mainly relies on natural parking, with localized disorderly parking. Shanyin Road maintains good parking order except for short-term congestion during school opening and closing times. Tian'ai Road already has a small number of marked non-motorized parking spaces, with supply and demand basically matched.

In terms of road damage, the overall condition of roads in the area is relatively stable, with damage of varying degrees only in localized sections. The northern section of Dongjiangwan Road and the southern section of Changchun Road show the most obvious road damage, exhibiting problems such as continuous cracking, potholes, and uneven road surfaces, with relatively urgent repair needs. Roads such as Sichuan North Road and Huangdu Road show a moderate level of damage, mainly manifested as numerous localized block repairs. The remaining roads are in relatively good condition.

In terms of neighborhood greening level, through on-site photography and street-view review analysis, the average neighborhood green view index of the area is 24.7%. The green view index of Duolun Road, Shanyin Road, Tian'ai Road, and the northern section of Sichuan North Road (Dongjiangwan Road–Shanyin Road) all exceed 20%, with street trees arranged in rows on both sides and a relatively complete tree–shrub–grass configuration, resulting in good visual greenery and walking environment. In contrast, the southern section of

Sichuan North Road (Shanyin Road–Hailun West Road) has a markedly low green view index (below 15%); along this section, street-front commercial premises are dense, the number of street trees is limited, and the planting spacing is large, with an obvious lack of plant landscape.

3.4. Inefficient idle resources

Through systematic research, the grading of inefficient idle spaces is determined by comprehensively considering vacancy level, location value potential, and ease of renovation, as shown in Table 2. The inefficient idle resources in the area are divided into three grades: Grade I idle spaces have a high vacancy rate and large location influence, representing prominent points of resource waste, and are included as priorities in near-term activation work; Grade II idle spaces have a relatively high vacancy rate and certain reuse potential, and are placed under continuous monitoring and incorporated into the mid-term renewal plan; Grade III idle spaces do not yet meet the conditions for renewal and renovation implementation, and serve as reserve resources for future functional optimization and quality improvement. Through graded and classified identification, a basis is provided for categorized and targeted measures in subsequent spatial activation.

Table 2. Grading criteria for inefficient idle resources

Vacancy Level	Value Potential (Location Influence)	Ease of Renovation	Idle Space Grade	Renewal Suggestion
Continuous vacancy ≥ 12 months Average annual vacancy rate ≥ 50% No short-term use plan	Adjacent to core alleys (Sichuan North Road, Duolun Road, Tian'ai Road, etc.), historic buildings, or public space nodes, with significant location advantages	Sound building structure and good stylistic coordination No major property rights disputes Renovation requires no breach of conservation requirements	Grade I Idle Space	Prioritize Activation
	After activation, can link surrounding businesses or enhance public service capacity			
	Located in secondary alleys of the conservation area or concentrated residential zones, close to community supporting facilities	Basically sound building structure Requires partial repair to suit conservation requirements		
Average annual vacancy ≥ 30% Unstable usage status	After activation, can meet local area demands, with moderate driving effect on the overall conservation area	Slight need for property rights sorting	Grade II Idle Space	Steady Progress
Continuous vacancy < 6 months Average annual vacancy rate < 30% Possible temporary use	Located at the edge of the conservation area, far from core nodes	Building structure requires major reinforcement Relatively obvious stylistic conflicts Complex property rights relations, renovation requires coordination among multiple departments	Grade III Idle Space	Long-term Reserve
	After activation, limited driving effect on the area, mainly meeting basic functional supplementation			

According to the classification criteria, a total of 11 inefficient idle spaces are identified in the Shanyin Road Conservation Area, with a combined total floor area of about 18,600 m², a proportion of functionally

inefficient resources of 36.4%, and a considerable proportion of idle spaces having a high vacancy rate, making the activation task heavy. All idle spaces have clear ownership and a safety hazard incidence rate of 0%, providing basic conditions for subsequent categorized measures. Among them, there are 2 Grade I idle spaces—the Honghui Market (Chuanbei Vegetable Market) and the Space 188 Park (Jintai Auction)—both with an average annual vacancy rate above 50% and basically safe building structures, for which prioritized activation is recommended. There are 2 Grade II idle spaces—the Shanghai Electronic Control Research Institute of China South Industries Group and the Shanghai Hongkou Garment Co., Ltd.—both with an average annual vacancy rate above 30% and basically safe building structures, but with insufficient overall space utilization, for which steady progress in renewal is recommended. There are 2 Grade III idle spaces—a single-story building and a warehouse—currently pending requisition or idle, for which long-term tracking and planning guidance are recommended. The remaining 5 inefficient idle spaces mainly suffer from inefficient operation and insufficient vitality, and are tentatively placed under long-term tracking management, with activation to be considered when conditions mature.

In addition, there are 46 idle underground spaces in the Shanyin Road Conservation Area, including 18 civil air-defense projects and 28 ordinary basements, representing relatively abundant underground space resources. After evaluation, 10 sites—including Luxun Middle School, Guomao Garden, Hongye Huayuan, Xinhua LvShe, Taiye Apartment, the Second Detachment of the Armed Police, and the Cadre Apartment Building—have the potential to be renovated into parking facilities, and the renovation of underground parking facilities is planned to be advanced in an orderly manner thereafter.

3.5. Renewal physical examination results

Based on the specialized renewal physical examination indicator system, the study quantitatively identifies the core problems of the Shanyin Road conservation core area and forms three major spatialized diagnostic outcomes—the problem map, the resource map, and the demand map. Through comprehensive evaluation, four types of prominent problems exist in the Shanyin Road conservation core area: (1) Historical and cultural resources show "emphasis on designation and recognition but neglect of repair and activation." Among the 103 protected buildings, the overall repair rate is only 33%; the lag in repairing immovable cultural relics is particularly prominent, a large number of red former sites find it difficult to open to the public, and the perceptibility and identifiability of red culture are weak. (2) Structural imbalance in commercial businesses. Traditional basic formats such as low-end catering account for a high proportion, while cultural-tourism experiences and age-friendly service supply face large gaps, and the four main streets show serious divergence in pedestrian flow and consumption vitality. (3) Local shortcomings exist in the neighborhood living space. Livelihood pain points such as saturated parking resources, localized road damage, uneven distribution of the neighborhood green view index, and disorderly non-motorized vehicle parking are concentrated. (4) The total volume of inefficient idle stock resources is large. The idle resources in the area total 18,600 m², the graded activation mechanism is lacking, and spatial value has not been effectively released.

Based on the quantitative measurement of the four-dimensional indicators, full-area field surveys, GIS spatial overlay, and cross-verification with resident questionnaires, three types of spatial visualization outcomes—the problem map, resource map, and demand map—are integrated, achieving precise spatial positioning of the area's shortcomings, stock value, and livelihood demands, and providing an intuitive spatial basis for differentiated street renewal.

(1) The problem map presents the spatial agglomeration characteristics of shortcomings, mainly consisting of three major types—historical culture, neighborhood space, and community living. Historical-culture shortcomings are concentrated along Liyang Road and Shanyin Road, with a large number of culturally

protected buildings lagging in repair, multiple celebrity former residences difficult to open to the public due to property rights issues, and a fracture in red-culture display. In terms of neighborhood-space shortcomings, the southern section of Sichuan North Road and Duolun Road show prominent illegal non-motorized parking, and the northern section of Dongjiangwan Road and the southern section of Changchun Road show road damage. Living shortcomings are concentrated in the old lanes of Shanyin Road and Liyang Road, where waterlogging and lack of property management exist. Overall, the enclosed area of Liyang Road–Shanyin Road–southern Sichuan North Road is the core zone of overlapping problems and the priority core area for renewal remediation; Duolun Road and Tian'ai Road show scattered, point-like problem distribution, mainly characterized by homogeneous businesses and insufficient supporting facilities, with a secondary remediation priority.

(2) The resource map presents the distribution characteristics of existing potential spaces, dividing them into three types of potential carriers—idle spaces, cultural resources, and businesses pending renovation. The Grade I activation spaces (Honghui Market, Space 188 Industrial Park) and Grade II renewal factories are concentrated in the Dongjiangwan Road–Sichuan North Road area, coinciding with the problem-concentrated zone. The area possesses 41 red former sites, celebrity former residences, art galleries, and bookstores, forming a natural red cultural-tourism corridor, yet a large number of sites are closed with insufficient connectivity, resulting in fragmented red resources. All four main streets have the conditions for business upgrading; Sichuan North Road is suited to diversified consumption upgrading potential, while Duolun Road and Tian'ai Road can embed characteristic thematic formats. Overall, the existing resources are highly coupled with the area's shortcoming spaces, and idle spaces can be used to supplement public and cultural supporting facilities, simultaneously resolving the dual contradictions of environmental shortcomings and resource idleness.

(3) The demand map reflects the spatial distribution characteristics of residents' demands. Residents in the old lanes along Liyang Road, Shanyin Road, and Duolun Road have the lowest satisfaction, with core demands in the order of parking and charging, environmental remediation, age-friendly renovation, and public service supporting facilities; Tian'ai Road and Duolun Road show prominent gaps in facilities such as community canteens. The low-satisfaction and high-demand zones highly overlap with the shortcomings in the problem map and the idle spaces in the resource map; the existing idle spaces can be prioritized for building livelihood supporting facilities such as community canteens, convenient elderly-care points, and shared parking, achieving two-way precise matching between livelihood demands and stock activation.

4. Renewal strategy recommendations

Based on the physical examination results of the area, the Shanyin Road Historical and Cultural Conservation Area exhibits interwoven and overlapping problem characteristics in functional positioning, business structure, spatial quality, and resource activation. Block renewal must not only respond to the macro demands of regional comprehensive development, but also directly address residents' urgent needs for improved living environments, enhanced public services, and elevated cultural experiences. In view of the specific problems identified in the physical examination for the four main streets—Sichuan North Road, Duolun Road, Shanyin Road, and Tian'ai Road—"street-specific strategy" renewal countermeasure recommendations are proposed, aiming to promote the block's transformation from "static preservation" to "vibrant revitalization" through refined "acupoint-style" interventions and systematic functional enhancement.

4.1. Sichuan North Road: functional reinvention of the comprehensive consumption axis

The main problems facing Sichuan North Road include low spatial environmental quality, insufficient activation of historical and cultural resources, disordered traffic and street order, and a mismatch between business and functional structures, which constrain the enhancement of its commercial vitality and functional iteration. Renewal strategy recommendations: (1) In the near term, improve comprehensive street-environment remediation. Centered on the goals of "green, orderly, and smooth," focus on compensating for greening shortcomings by adding pocket parks wherever possible and promoting three-dimensional wall greenery, thereby enriching vegetation layers and public leisure spaces; systematically plan non-motorized vehicle parking zones, set up dedicated temporary parking spaces and time-limited parking areas for takeout riders, and strengthen parking guidance and management; comprehensively renovate damaged roads and upgrade paving to enhance pedestrian and vehicular comfort and shape a clean and orderly street image. (2) In the medium term, enhance the identifiability of red cultural resources. Using the protection and repair of historic buildings as the starting point, carry out functional repair and adaptive renovation of key culturally protected buildings, and combine digital technology, guide systems, and open activities to enhance their cultural display and public participation functions; connect the red historical sites within and around the block to create a red-cultural walking route that is passable, readable, and experienceable, strengthening the block's cultural identifiability. (3) In the long term, advance the gradual optimization and innovation of business formats. Formulate a positive list to guide business formats, encourage the transformation and upgrading of traditional inefficient commercial spaces, and actively introduce emerging consumer formats such as independent designer brand stores, boutique cafés, cultural composite bookstores, and experience workshops, cultivating small-but-beautiful community commercial nodes; promote the renewal of consumption scenarios through business-format iteration, realizing a functional shift from a living-service axis to an experiential cultural-commercial axis.

4.2. Duolun Road: a walkable open-air historical and cultural experience block

The main problems facing Duolun Road are homogeneous businesses, low integration of cultural resources, obvious fragmentation, disordered non-motorized vehicle parking, and an actual experience that deviates from its positioning as a "walkable open-air historical and cultural museum," with its cultural advantages failing to be effectively transformed into cultural-tourism attractiveness. Renewal strategy recommendations: (1) In the near term, implement street-order remediation. Designate non-motorized vehicle parking zones, add marked parking spaces and guiding signs, and improve the street traffic environment. (2) In the medium term, advance the creation of cultural routes and the activation of idle spaces. Renovate historically protected buildings in stages, integrate the red cultural resources within the block, create walkable experiential cultural routes, and enhance cultural accessibility and display effects; simultaneously activate inefficient idle spaces such as the Gongfei Book Society within the area, and combine with the age-friendly renewal of surrounding markets to create exhibition and hands-on experience spaces. (3) In the long term, promote the diversified and experiential transformation of business formats. Gradually guide antique and curio retail toward diversified experiential formats such as cultural-creative retail, light catering and coffee, and cultural interactive activities, realizing the integration of curio collection with mass cultural tourism.

4.3. Shanyin Road: a lively living zone shared by residents and visitors

The main problems facing Shanyin Road are a clear mismatch between the existing businesses and residents' actual needs, a lack of age-friendly service facilities, a lagging business structure, and insufficient impetus in both serving residents and attracting visitors. Renewal strategy recommendations: (1) In the near term,

improve the configuration of age-friendly businesses. Actively introduce elderly-friendly commercial and service facilities such as comprehensive supermarkets, convenience pharmacies, and health service stations to meet the daily living and health-management needs of the aging community. (2) In the medium term, advance the creation of an age-friendly block. Through leveling roads, adding rest nodes, and improving lighting and wayfinding, create a safe, continuous, and comfortable age-friendly block, enhancing the slow-traffic experience for residents and visitors of all ages. (3) In the long term, reshape the block's positioning. Combining cultural resources with community-living characteristics, balance residents' daily consumption with visitors' light-experience needs, and create a lively living zone shared by residents and visitors.

4.4. Tian'ai Road: a love landmark and a habitat for the romantic spirit

The main problems facing Tian'ai Road are a singular business structure, a lack of in-depth experience spaces, insufficient utilization of thematic resources, and limited overall romantic supporting industries and services, making it difficult to form complete consumption scenarios and emotional memory spaces. Renewal strategy recommendations: (1) In the near term, advance the improvement of the block's environment and image. By adding romantic-themed check-in points along the street, enriching interactive interfaces, and regularly organizing themed activities, strengthen the block's atmosphere and enhance the image of the love-themed block. (2) In the medium term, promote the introduction and linkage of the wedding industry. Attract the wedding industry to settle in, link with the marriage registration office, and create integrated wedding-service nodes, realizing the effective fusion of thematic resources and commercial functions. (3) In the long term, achieve the integration of romantic business formats. Centered on recording romance and celebrating romance, integrate and introduce related formats such as themed photography, customized gifts, and light-luxury catering, forming a one-stop romantic experience service chain of "styling—photography—celebration—commemoration," building a love-block brand, and enhancing the block's overall attractiveness and consumption potential.

5. Conclusions and prospects

5.1. Main conclusions

Taking the 71.76-hectare core area of the Shanyin Road Historical and Cultural Conservation Area in Shanghai as the research subject, this paper constructs a specialized renewal physical examination framework based on the multiple renewal demands of the conservation area, and through multi-source data fusion and spatial visualization analysis, systematically identifies the four core problems of the conservation area and proposes localized renewal strategies. The main conclusions are as follows:

(1) At the level of the physical examination framework: in response to the multiple core demands of the Shanyin Road Conservation Area—conservation protection, functional development, livable livelihood, and resource activation—a 20-item specialized renewal physical examination indicator system suited to the characteristics of residential historical conservation areas is constructed, forming a complete physical-examination technical path of "indicator diagnosis—field verification—spatial positioning," which compensates for the insufficient adaptability of the existing urban physical examination system to historical conservation areas.

(2) At the level of problem diagnosis: four types of prominent problems in the Shanyin Road conservation core area are systematically identified—the total volume of historic buildings is sufficient but investment in repair lags, and the shortcomings in the protection, activation, and utilization of cultural-relic buildings are particularly prominent; there is a supply-demand mismatch in commercial businesses, with a high proportion

of low-end catering and insufficient cultural-tourism experience, and significant divergence in street pedestrian-flow vitality; localized livability shortcomings exist in block traffic, greenery, and slow-traffic spaces; and the scale of inefficient idle stock resources is large, with a heavy activation task. Simultaneously, three types of spatial thematic maps—problem, resource, and demand—are formed, realizing the visualized positioning of the area's shortcomings and potential resources, and providing a precise spatial basis for renewal planning.

(3) At the level of renewal application: based on the differentiated physical-examination results of the area's streets, "street-specific strategy" renewal strategies are proposed, opening up the working path of "physical-examination indicator shortcomings—spatial problem positioning—phased renewal measures," fully verifying the feasibility of the "physical examination first, renewal second" model in historical and cultural conservation areas, and providing a replicable practical paradigm for the integrated physical-examination-and-renewal of similar historical areas in China.

5.2. Research prospects

This study still has the following limitations: first, the indicator system remains to be perfected; the currently constructed four-dimensional indicators have not yet covered all physical-examination contents, and need to be further enriched and optimized in light of practical experience; second, this study covers only the core area of the Shanyin Road Historical and Cultural Conservation Area, and the generalizability of the physical-examination indicators needs to be verified by more cases; third, the data collection is single-time-point data, lacking dynamic comparison, and thus it is difficult to reflect the dynamic characteristics of the conservation area's renewal and development.

Looking ahead, research can be deepened in the following aspects: first, establish a dynamic monitoring system that accumulates year-by-year data through regular physical examinations and tracks and evaluates the implementation effects of renewal strategies; second, carry out multi-case comparative research, applying this study's physical-examination framework to other historical and cultural conservation areas in Shanghai and even the Yangtze River Delta region, so as to test and optimize the generalizability and specificity of the indicators; third, explore AI-assisted urban physical examination methods, using machine learning, computer vision, and other technologies to realize functions such as automatic architectural-style recognition and dynamic monitoring of idle spaces, thereby improving the efficiency and accuracy of refined physical examination in historical and cultural conservation areas.

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