

# Adaptive Evolution of Traditional Settlements along the Chengdu-Chongqing Ancient Road in the Context of Transportation History Research

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**Abstract:** This study explores the impact of traffic changes on the morphological evolution of traditional settlement spaces along the Chengdu-Chongqing Ancient Road, revealing their laws of adaptive development to provide references for current cultural heritage conservation and rural revitalization. Based on historical document analysis and field surveys, and integrated with Geographic Information System (GIS) technology, the research traces the trajectory of traffic development from ancient times to the present. It selects typical settlements such as Zouma Town and Luoquan Town for case studies. The results indicate that the spatial layout of settlements has long relied on the ancient road routes, exhibiting characteristics of distribution along traffic lines and equidistant spacing; their internal structures and architectural forms have also dynamically adjusted with the rise and fall of traffic functions. The study finds that changes in transportation modes are the core driving force behind settlement evolution, while the adaptability of local societies plays a key role in spatial transformation. The conclusion argues that the Chengdu-Chongqing Ancient Road should be protected from the holistic perspective of linear cultural heritage. Through constructing cultural corridors and developing educational tourism, the revitalization and sustainable development of traditional settlements can be achieved.

**Keywords:** Chengdu-Chongqing Ancient Road; Traditional Settlements; Traffic Changes; Spatial Evolution; Adaptability; Cultural Heritage Conservation

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## 1. Introduction

### 1.1 Research Background

Against the macro backdrop of the "Chengdu-Chongqing Twin City Economic Circle" being elevated to a national strategy, re-examining and sorting out the historical and cultural context within the region holds profound significance for shaping its unique regional identity and promoting high-quality humanistic development<sup>[1]</sup>. The Chengdu-Chongqing Ancient Road, this traffic artery winding through basin hills and traversing a millennium, was once the economic and cultural lifeline connecting Sichuan and Chongqing societies<sup>[2]</sup>. It not only transported goods and people but also spawned and nurtured numerous towns and villages along its route, forming a distinctive linear cultural landscape<sup>[3]</sup>.

Rapid urbanization and the reconstruction of modern traffic networks have posed severe survival challenges to traditional settlements along the Chengdu-Chongqing Ancient Road. Since modern times, with the emergence of modern transportation such as the Chengdu-Chongqing Railway and the Sichuan-Shaanxi Highway, the ancient road gradually exited the historical stage, causing a fundamental turning point in the development trajectory of settlements along the line<sup>[5]</sup>. Currently, these settlements exhibit distinct polarization

and functional alienation in their development: some settlements, due to their distance from modern traffic nodes, have gradually lost economic vitality, with formerly bustling post-road old streets facing the decline dilemmas of vacant alleys and aging facilities; some settlements, although gaining vitality through cultural and tourism development, have fallen into the predicament of excessive commercialization and loss of cultural authenticity due to a lack of respect for historical contexts; others have been squeezed during the expansion of new towns, with their traditional street patterns and architectural textures damaged, such as the old street of Taiping Town in Chengdu being compressed into a corner by the new town <sup>[10]</sup>. How to resolve the contradiction between "protection and development" and achieve the adaptive regeneration of settlement spaces has become an urgent practical problem in the process of urbanization.

### **1.2 Research Objectives**

To systematically sort out the complete history of traffic changes of the Chengdu-Chongqing Ancient Road from its inception, peak, to transformation, clarifying its functional characteristics and development drivers at different historical stages. To deeply reveal how the spatial morphology of traditional settlements along the ancient road responded to changes in traffic conditions, and what regular evolutions occurred at the macro-distribution, meso-pattern, and micro-architectural levels. To construct an analytical framework for the "traffic-settlement" interactive relationship, going beyond simple causal relationships to explain the internal logic and complex motivations behind the adaptive evolution of settlement spaces. To project the conclusions of historical research onto reality, providing actionable strategic suggestions for the holistic protection of the Chengdu-Chongqing Ancient Road as a linear cultural heritage and for the sustainable development of settlements along the line under the background of rural revitalization.

### **1.3 Research Significance**

This study breaks through the limitation of traditional settlement research that focuses on "villages in isolation," systematically analyzing the long-term evolution mechanism of settlement spaces along the Chengdu-Chongqing Ancient Road, thereby making up for the deficiencies in existing research that "emphasizes form over mechanism" and "focuses on statics over dynamics." By introducing quantitative analysis methods to establish a correlation model between traffic and settlements, it expands the methodological system for research on the co-evolution of linear cultural heritage and settlements, providing a referenceable analysis paradigm for similar studies of settlements along linear heritage sites.

The research results can directly guide cultural heritage conservation practices in the Chengdu-Chongqing Twin City Economic Circle: for settlements marginalized by traffic, the concept of three-level classification protection for ancient roads can be referenced to prioritize the protection of post-road relics and traditional street patterns. By activating spatial functions through cultural display and the implantation of local industries, an organic integration of traditional spaces and cultural tourism formats can be achieved, avoiding homogeneous development. Meanwhile, the typical case library and strategy system formed by this study can provide practical references for the living inheritance of similar ancient road settlements in Southwest China and even nationwide, aiding rural revitalization and urban-rural integrated development <sup>[26]</sup>.

## **2. Literature Review**

### **2.1 Introduction**

As an important land channel connecting the Chengdu Plain and the Chongqing area, the Chengdu-Chongqing Ancient Road not only witnesses the historical changes of the Chengdu-Chongqing region

but also profoundly influences the formation and evolution of traditional settlements along its line. From the perspective of traffic history, this paper systematically reviews research achievements on the adaptive evolution of traditional settlement spaces along the Chengdu-Chongqing Ancient Road, aiming to explore the dynamic mechanisms and evolution laws of traditional settlements under the influence of traffic changes, providing theoretical support for the protection and sustainable development of traditional settlements in the Chengdu-Chongqing region.

## **2.2 Historical Evolution Research of the Chengdu-Chongqing Ancient Road**

The historical evolution of the Chengdu-Chongqing Ancient Road is the foundation for studying the spatial evolution of traditional settlements. Jin Hang (2015) conducted in-depth research on the historical context and cultural value of the Chengdu-Chongqing Ancient Road, pointing out that as an important trade route during the Ming and Qing dynasties, it connected the economic and cultural exchanges between Chengdu and Chongqing, forming a unique "Post Road Culture"<sup>[5]</sup>. Li Dadi et al. (2020), through archaeological trial excavations of handicraft sites in the Zouma area of the Chengdu-Chongqing Ancient Road, revealed the close connection between the ancient road and the economic development of settlements, indicating that the ancient road was not just a traffic route but also a carrier of economic and cultural exchanges<sup>[6]</sup>. Zhao Xing and Chen Si (2019) explored the characteristics of Bayu culture through poetry, indirectly reflecting the cultural prosperity brought to settlements along the ancient road<sup>[7]</sup>.

## **2.3 Spatial Evolution Research of Traditional Settlements along the Chengdu-Chongqing Ancient Road**

The spatial evolution of traditional settlements is one of the core issues in Chengdu-Chongqing Ancient Road research. Chen Qian and Wang Quankang (2013) studied the cultural heritage of ancient salt industry in Bayu and its tourism development value, pointing out that the salt culture along the ancient road had a profound impact on the spatial layout of settlements, forming a unique "Salt Road Culture"<sup>[8]</sup>. Zhang Hong (2011) analyzed the protection of Sichuan salt culture resources and the development of the tourism industry, emphasizing the importance of the ancient road in the formation of settlement spaces<sup>[9]</sup>. Du Ran (2026) reviewed the 4th Academic Symposium on Cultural Studies (Mass Cultural Studies) and the Belt and Road "Station Forum" Doctoral Interdisciplinary Dialogue Conference, proposing that as a linear cultural heritage, the ancient road has a significant impact on the spatial structure of settlements<sup>[29]</sup>.

## **2.4 Research on Adaptive Evolution of Traditional Settlement Spaces**

Adaptive evolution is a key characteristic of traditional settlement space evolution. Yang Ren et al. (2026) studied the synergistic activation mechanism of linear cultural heritage and the construction of cultural identifiers for traditional villages along the Nanyue Ancient Post Road, proposing that traditional settlements achieve adaptive development through cultural identifiers and spatial reconstruction<sup>[1]</sup>. Guo Ruoqi et al. (2026) explored university pathways and mechanism innovations for the digital inheritance of characteristic cultural heritage, pointing out that digital technology provides new possibilities for the adaptive protection of traditional settlement spaces<sup>[2]</sup>. Bi Jiantao and Wang Xingxing (2026) studied the application and research progress of spatial information technology in the historical changes of the Silk Road, providing technical support for research on the adaptive evolution of settlement spaces<sup>[3]</sup>.

### **2.5 Research on the Impact of Traffic Changes on Traditional Settlements**

Traffic changes are an important driving force for the spatial evolution of traditional settlements. Shi Yanwen et al. (2026) studied the spatiotemporal coupling and obstacle factors of agricultural modernization and urban-rural integration, pointing out that the improvement of traffic conditions promoted the flow of elements between urban and rural areas, thereby influencing the spatial evolution of settlements. Li Baimin et al. (2026) studied the spatial synergy and interaction effects between rural development and traffic advantage in Guangxi counties, revealing the promoting effect of traffic conditions on settlement development. Ding Xianyong and Liu Junfeng (2012) reviewed the "2nd Academic Symposium on Modern Chinese Traffic Social History," emphasizing the profound impact of traffic changes on social structure and settlement spaces.

The integrated development of traffic heritage and cultural tourism is an important path for the adaptive evolution of traditional settlements. Tao Li et al. (2025) studied the integrated development of traffic heritage and cultural tourism, proposing that as traffic heritage, ancient roads can drive the economic development of settlements through cultural tourism integration. Yin Yanqiong and Yang Puyi (2025), from the perspective of human-land relationships, studied the development and changes of Heijing Ancient Town, pointing out that as a major traffic thoroughfare, the ancient road has a significant impact on the economic and social development of settlements. Ruiyuan, W. A. N. G., & Baoyi, W. A. N. G. (2025) studied the impact effect of traffic modernization on the level of Chinese-style modernization, emphasizing the important role of traffic in regional development.

### **2.6 Research on the Integrated Development of Traffic Heritage and Cultural Tourism**

The integration of transport heritage and cultural tourism is a crucial path for the adaptive evolution of traditional settlements. Tao Li et al. (2025) studied the integration of transport heritage and cultural tourism, proposing that ancient roads, as transport heritage, can drive the economic development of settlements through cultural tourism integration. Yin Yanqiong and Yang Puyi (2025) studied the development and changes of Heijing Ancient Town from the perspective of human-land relations, pointing out that as a vital transportation artery, the ancient road significantly impacted the settlement's economic and social development. Ruiyuan, W. A. N. G., & Baoyi, W. A. N. G. (2025) studied the effect of transportation modernization on the level of Chinese-style modernization, emphasizing transportation's important role in regional development.

### **2.7 Research on the Protection and Utilization of Ancient Road Resources**

The protection and utilization of ancient road resources are crucial for the sustainable development of traditional settlements. Jin Pan et al. (2025) studied the current status and protection countermeasures of ancient road resources, proposing that the protection of ancient road resources should be combined with settlement development to achieve a win-win situation. Chen Qiaofei et al. (2024) studied digital intelligence empowering the protection and inheritance of cultural heritage, pointing out that digital technology can provide new means for the protection of ancient road resources. Su Lujun et al. (2023) studied the theoretical logic and implementation paths for promoting common prosperity through the integrated development of culture and tourism, providing theoretical guidance for the protection and utilization of ancient road resources.

### **2.8 Conclusion and Outlook**

From the perspective of traffic history, this paper reviews the research achievements on the adaptive evolution of traditional settlement spaces along the Chengdu-Chongqing Ancient Road. Existing research has achieved rich results in aspects such as the historical evolution of the ancient road, settlement spatial evolution, adaptive evolution, and the impact of traffic changes. However, there are still some shortcomings, such as

insufficient in-depth research on the micro-mechanisms of settlement spatial evolution and a lack of systematic research on adaptive evolution. Future research should further deepen the study of micro-mechanisms in settlement spatial evolution, strengthen the application of digital technology, and promote the sustainable development of traditional settlements along the Chengdu-Chongqing Ancient Road.

### **3. Historical Context of Traffic Changes on the Chengdu-Chongqing Ancient Road**

#### **3.1 Ancient Formation and Early Development**

The prototype of the Chengdu-Chongqing Ancient Road began in the Qin and Han dynasties, initially opening up alongside the central government's administration of the southwest Bashu region and the establishment of the commandery-county system. The Qin built plank roads to connect Guanzhong, and the Han expanded post roads to reach Bashu. During this stage, path selection was mainly constrained by the rugged natural geographical pattern, mostly winding along deeply cut river valleys, forming the primitive linear characteristic of "roads formed by water, paths chiseled by mountains." At this time, settlement spaces had not yet formed large-scale agglomerations; they were only sporadically scattered around key ferries, passes, and post stations, presenting a point-like distribution pattern dependent on traffic nodes, with single spatial functions.

Entering the Sui and Tang dynasties, with the consolidation of the great unity and the rise of the southern economy, the traffic grade of the ancient road significantly improved, and the post transmission system became increasingly perfect. Route selection began to shift from purely military defense to considering commercial circulation. Paths gradually optimized from rugged river valley lowlands to relatively gentle mountain ridge terraces, greatly improving passage efficiency. Driven by this, settlements along the line began to slowly extend along the road axis, initially showing signs of linear growth. Early service facilities such as guesthouses and taverns appeared around post stations, and the internal spatial structure of settlements began to reorganize preliminarily around traffic functions, laying the spatial evolution foundation for the later "markets rising due to roads," marking the historical starting point of the Chengdu-Chongqing Ancient Road's transformation from a military channel to an economic and cultural corridor.

During the Song and Yuan dynasties, the Chengdu-Chongqing Ancient Road ushered in a key turning point in the institutionalization and standardization of its traffic network, with the post road system achieving preliminary perfection in both breadth and depth. In the Song Dynasty, given the national policy of "valuing literature over martial arts" and the prominent status of the Sichuan-Chongqing region's economic taxation, the court vigorously repaired old roads, establishing a standardized post road system with Chengdu and Chongqing as the two poles, connecting prefecture and county seats in between. During this period, road selection became more rational; by cutting bends and straightening lines and reinforcing roadbeds, the stability and continuity of land transport were significantly improved, transforming the ancient road from intermittent dangerous paths into a coherent traffic artery [10].

Accompanying the intensification of the post transmission system, the settlement spaces along the line began to undergo structural reshaping. The standardized setting of official post stations not only strengthened the administrative functions of nodes but also spawned commercial settlement clusters surrounding station services. Settlement distribution gradually evolved from early random point-like dependence into a chain-like structure arranged orderly along the post road axis, with the pattern of "one shop every ten li, one station every thirty li" initially taking shape. In terms of architectural form, to meet the increasingly frequent needs of merchants and travelers for food and lodging, specialized public spaces such as inns and warehouses began to

appear within settlements. Street interfaces gradually opened up to traffic flows, forming the early functional prototype of "shops in front, residences in back"[6]. The spatial evolution in this stage marked the formal shift of Chengdu-Chongqing Ancient Road settlements from a military defense orientation to a commercial service orientation, laying a solid spatial foundation for the maturity of the linear town belt in the Ming and Qing dynasties [7].

### 3.2 Peak Period in Ming and Qing Dynasties

During the Ming and Qing dynasties, the Chengdu-Chongqing Ancient Road reached its historical peak. The status of the "East Main Road" as the official main artery connecting Chengdu and Chongqing was completely solidified, becoming the core axis maintaining the political, economic, and cultural lifeline between Sichuan and Chongqing. In this period, the court carried out systematic stone paving and standardized construction of the post road. Road width, slope, and drainage facilities all reached the pinnacle of traditional construction technology, forming a stable and efficient linear traffic corridor. The high-frequency normalization of traffic flow directly drove explosive growth in settlement spaces along the line, evolving the post station system from purely administrative nodes into functionally composite regional centers.

In terms of spatial morphology, settlements strictly followed the evolutionary logic of "streets formed by roads, towns built upon stations," presenting a highly mature linear strip layout<sup>[8]</sup>. Not only did administrative agencies such as government offices and military posts aggregate around post stations, but large-scale commercial blocks also derived, forming the spatial isomorphism characteristic of "station equals town, town equals market"<sup>[9]</sup>. Street spaces achieved separation of pedestrians and vehicles and weather-proof commercial activities through the treatment of gray spaces like verandas and eaves corridors, significantly increasing building density and floor area ratio. Internal functional zoning became increasingly refined; logistics storage, passenger transit, and residential living spaces were efficiently coupled in vertical and horizontal dimensions, marking that the adaptive evolution of settlement spaces along the Chengdu-Chongqing Ancient Road reached the highest form under traditional agricultural civilization, constructing a highly resilient traffic-settlement symbiotic system<sup>[16]</sup>.

In the mid-to-late Ming and Qing dynasties, accompanied by the deepening of the "Huguang fills Sichuan" migration wave and the full activation of regional markets, the Chengdu-Chongqing Ancient Road ushered in a historical peak in commodity economy and logistics transportation. The frequency of cross-regional circulation of bulk materials such as salt, tea, cloth, and grain increased dramatically, transforming the ancient road from a single administrative post road into a busy commercial logistics artery. This high-intensity logistics demand directly reshaped the spatial texture of settlements along the line, prompting a sharp expansion in settlement scale and continuous strip-like extension along the traffic axis, creating a prosperous scene of "different skies every ten li, markets in every village"<sup>[17]</sup>.

To cope with enormous cargo throughput pressure, the internal spatial structure of settlements underwent profound functional reconstruction. Professional warehouses, ticket banks, and wholesale firms were densely distributed on both sides of core streets. Street sections achieved efficient organization of pedestrian and cargo separation by widening main roads, adding unloading platforms, and deepening eaves gray spaces. In terms of architectural form, deep-depth "shops in front, warehouses in back" and multi-story vertical storage models became mainstream. Skylights and high side windows were utilized to solve lighting and ventilation problems in deep spaces, greatly improving the logistics carrying efficiency per unit of land. In addition, traffic nodes such as wharfs and passes evolved into comprehensive logistics hubs, surrounded by supporting service formats such

as portering and packaging, forming a hierarchical and functionally complementary linear commercial network, marking that the adaptability of settlement spaces to traffic logistics functions reached its extreme.

### **3.3 Modern Transformation and Functional Transition**

Entering the modern era, with the impact of Western industrial civilization and the introduction of modern traffic technologies, the traffic pattern of the Chengdu-Chongqing Ancient Road underwent unprecedented drastic changes, and its traditional dominant position faced severe challenges from emerging road and railway networks. In the early 20th century, the construction of the Chengdu-Chongqing Highway marked a fundamental turning point in regional transportation modes from human and animal power to mechanized transport. The route selection logic of the ancient road was forced to give way to modern engineering standards; stone slab paths originally winding along mountain ridges and river valleys were gradually replaced by straightened gravel or asphalt roads, causing a large number of settlements along the line that relied on the ancient road for survival to face a marginalization crisis <sup>[21]</sup>. During this period, the adaptive evolution of settlement spaces presented significant differentiation characteristics: settlements located at new highway nodes or able to successfully dock with the modern traffic system quickly adjusted their spatial structures, widening traditional streets to accommodate car traffic. Building facades along the streets incorporated Western decorative elements, and functions shifted from traditional post station supplies to modern car repair, fuel supply, and commercial services, achieving a modern transformation of spatial morphology. Conversely, those settlements that stuck to the original ancient road lines and could not access the new traffic network fell into decline due to a cliff-like drop in human and material flows. Their internal spaces experienced hollowing out; formerly bustling commercial markets gradually degenerated into enclosed residential areas, and some road sections even returned to natural vegetation cover, showing the passive contraction and ecological retreat of the settlement organism after the loss of traffic kinetic energy [20]. In addition, during the War of Resistance against Japanese Aggression, the special mission of the Chengdu-Chongqing Ancient Road as a lifeline in the strategic rear briefly strengthened its spatial functions of military defense and material rush-transportation, spawning a large number of temporary storage and air defense facilities embedded in the traditional texture [19]. This diverse adaptation strategy presented under turbulent situations profoundly reveals the vulnerability and resilience of traditional settlement spaces in the face of intergenerational substitution of traffic technologies. The rise and fall of their spatial morphology is not only a direct projection of traffic route changes but also a vivid portrayal of spatial reconstruction of regional society in the modernization process, providing a key historical section for understanding the settlement evolution mechanism driven by traffic reform <sup>[3]</sup>.

### **3.4 Contemporary Decline and Cultural Remains**

Stepping into the contemporary era, with the three-dimensional completion of the Chengdu-Chongqing Expressway, high-speed railway, and aviation networks, the regional traffic pattern underwent a subversive reconstruction. The functional value of the traditional Chengdu-Chongqing Ancient Road as a logistics channel was completely dissolved, and settlements along the line subsequently fell into an unprecedented marginalization dilemma. The strong siphoning of human and material flows by modern traffic trunk lines caused formerly bustling towns along the ancient road to rapidly fade. A large outflow of young and middle-aged labor force led to serious "hollowing out" phenomena within settlements. Traditional street and alley spaces deteriorated day by day due to a lack of daily maintenance; some road sections were even buried by weeds or indiscriminately cut by modern construction, facing the risk of fracture in their originally continuous

and complete spatial texture. However, it was precisely against the background of this functional decline that the cultural relic value of the ancient road became prominent. Its role transformed from a purely economic artery into a historical and cultural corridor carrying regional memory and nostalgia emotions. The adaptive evolution of settlement spaces entered a new stage, shifting from "productive adaptation" to "protective regeneration."

In recent years, relying on the rise of the concept of linear cultural heritage protection, some settlements with complete styles have begun to explore spatial activation paths based on the integration of culture and tourism. By transforming abandoned post stations and guild halls into museums, homestays, or cultural and creative spaces, old buildings are re-endowed with contemporary functions. This evolution no longer pursues scale expansion but focuses on the repair of spatial quality and the reorganization of cultural narratives, attempting to find a balance point between preserving historical authenticity and meeting modern aesthetic needs. Although the overall trend still appears declining, these cultural remains scattered along the ancient road are like historical fossils. They not only record the traffic wisdom and survival philosophy of the Bashu ancestors over thousands of years but also become spatial media connecting the past and the future. The current state of existence of settlement spaces is essentially a silent response to the ultimate form of traffic changes. It warns that in the modernization process pursuing efficiency above all else, how to examine and continue those traditional spaces that have lost traffic functions but still possess profound cultural thickness has become a topic urgently needing in-depth discussion.

## **4. Types and Characteristics of Settlement Spatial Evolution**

### **4.1 Staging of Settlement Evolution**

The Incubation Period is the primitive breeding stage of the spatial morphology of traditional settlements along the Chengdu-Chongqing Ancient Road. Its core characteristic is manifested as high dependence on natural terrain and the initial sprouting of traffic functions. In this period, the ancient road path had not yet formed a regular artificial paving system but was naturally trampled out following mountain trends and water veins. Settlement site selection strictly followed the survival logic of "avoiding wind and facing the sun, being near water and close to roads," presenting a primary pattern of scattered point-like or short linear distribution<sup>[1]</sup>. The spatial scale was extremely limited; buildings were mostly simple thatched huts or Chuan-Dou wooden structures, sparsely arranged on both sides of the path, without yet forming continuous commercial interfaces or clear street hierarchy. At this time, the road-village relationship was in a passive state of natural symbiosis. Roads served only as passing media connecting adjacent villages and had not become the dominant force driving settlement expansion. Settlements lacked post stations or storage facilities specifically serving long-distance trade, with single and closed functional structures. Although this primitive spatial form appeared rough, it laid the geographical substrate for subsequent evolution. Its site selection wisdom conforming to terrain and its low-interference development mode constituted the most authentic ecological background color of Chengdu-Chongqing Ancient Road settlements, providing the initial reference system for spatial adaptive adjustments under later traffic pressures<sup>[14]</sup>.

The Development Period is the key stage for the maturation and expansion of the spatial morphology of Chengdu-Chongqing Ancient Road settlements. Its core driving force stemmed from the perfection of the official post road system and the surge in commercial traffic. With the comprehensive paving of stone slab roads and the establishment of the post station system in the Ming and Qing dynasties, the traffic axis became the absolute skeleton for settlement growth, inducing the spatial morphology to evolve rapidly from early scattered distribution to continuous strip-like texture. Settlements strictly extended with high density along both sides of

the road, forming the spatial paradigm of "road equals street, street equals market." Building interfaces closely fit the path, maximizing commercial display surfaces and passage efficiency within limited land through three-dimensional construction techniques such as stilted buildings (Diao Jiao Lou) and overhead street buildings. At this time, spatial functions underwent a qualitative leap; guild halls, inns, and warehouses specifically serving logistics and human flows were massively embedded into residential units. Street sections presented clear functional stratification, and public nodes such as market entrances and wharfs became hubs for spatial organization. This high-intensity axial expansion not only reshaped the physical boundaries of settlements but also constructed an open social network oriented towards traffic flow, marking the shift of settlement spaces from pure natural dependence to active solicitation and deep coupling with traffic economic values, establishing the most typical spatial genes of traditional market towns along the Chengdu-Chongqing Ancient Road<sup>[15]</sup>.

The Maturity Period marks that under the background of traffic flow reaching its historical peak, Chengdu-Chongqing Ancient Road settlements completed a structural transformation from linear expansion to connotative optimization. In this stage, the internal spatial texture of settlements tended to be highly complex and refined. The mode of simple extension along the road was limited by terrain and land boundaries, turning instead to digging into the deep hinterland, forming composite spatial forms such as "shops in front, residences in back," "shops downstairs, residences upstairs," and courtyards with multiple depths. The street and alley system derived rich branch alley networks from the single main axis. Through the skillful interspersions of node squares, wharf steps, and public buildings, a spatial sequence with clear levels and dense-sparsity order was constructed, effectively diverting high-intensity commercial human and logistics flows. Architectural forms and construction techniques reached a regional peak. Iconic elements such as firewalls, opera towers, and memorial archways not only strengthened spatial recognizability but also carried complex community ritual functions, making settlements evolve from purely traffic post stations into regional economic and cultural centers. At this time, traffic flow lines and daily life flow lines achieved efficient separation and organic integration in three-dimensional space. Spatial utilization efficiency reached its extreme, demonstrating the highest adaptability and sense of order that traditional settlements could achieve under given traffic constraints, leaving the most complete and highly valuable spatial samples for future research.

The Decline and Transformation Period began with the replacement of the ancient road by modern highway and railway networks in modern times. The stripping of traditional traffic functions led to a structural crisis in settlement spaces. Commercial interfaces originally extending along the ancient road axis rapidly lost vitality; street spaces saw large-scale vacancy and interface closure. Population outflow triggered building decay and spatial hollowing out, and continuous historical textures faced the risk of fracture. However, crises also bred transformation. Some settlements, relying on their remaining historical and cultural value, attempted to shift functions from "traffic channels" to "cultural corridors." The logic of spatial renewal shifted from economic efficiency orientation to heritage protection orientation. By implanting cultural and tourism formats through micro-renovation, they attempted to activate dormant resources while preserving traditional spatial genes, presenting a complex evolutionary picture of coexisting decline and regeneration.

#### **4.2 Evolutionary Characteristics of Location and Distribution Patterns**

The location selection and distribution patterns of traditional settlements along the Chengdu-Chongqing Ancient Road present a dynamic evolutionary trajectory from "natural geographical dependence" to "traffic axis coupling" and then to "network node solidification" [11]. In the early stage, settlement site selection was strictly

constrained by micro-topography, mostly scattered in closed units suitable for farming such as river valley terraces or mountain basins. The distribution pattern presented a discrete form of natural villages, with roads serving only as auxiliary lines connecting isolated units. As the traffic grade of the ancient road improved, the logic of settlement location underwent a fundamental reversal. Settlements began to actively approach and lock onto traffic trunk lines. The distribution pattern rapidly converged from area-like scattered points into a linear bead-string structure along the road direction, forming a typical strip-like community of "born due to roads, growing with roads" [29]. Entering the maturity period, key traffic nodes such as ferry crossings, passes, and post station locations, benefiting from the aggregation effect of human and material flows, evolved into regional central settlements. The distribution pattern further solidified into a network system of "main axis series, node radiation." This evolution of spatial distribution profoundly reveals the reorganization effect of traffic accessibility on settlement location potential; that is, the center of gravity of settlements always migrates and aggregates along the path with the highest traffic efficiency, finally shaping a linear cultural heritage corridor on the Chengdu-Chongqing Ancient Road that is well-organized and hierarchically distinct [4].

#### **4.3 Adaptive Embodiment in Internal Spatial Structure and Architecture**

The internal spatial structure and architectural form of traditional settlements along the Chengdu-Chongqing Ancient Road are not static geographical products but results of dynamic responses to linear traffic flows and complex mountainous terrains, presenting high functional resilience and spatial elasticity. At the macro spatial structure level, settlements broke through the closed centripetal layout paradigm of traditional agricultural villages, establishing an open linear skeleton with main streets as axes and alleys as veins [13]. Street section designs were dynamically adjusted according to the intensity gradient of human and material flows, forming a sequential characteristic of "wide and smooth main streets, deep and winding branch alleys, and enlarged node squares." This elastic spatial sequence not only effectively diverted high-intensity commercial transit traffic but also naturally divided different functional areas such as trading, resting, and passing through the rhythmic changes of street widths, achieving a balance between traffic efficiency and quality of life.

At the micro architectural form and construction technique level, settlements demonstrated extreme intensive utilization wisdom [12]. Facing steep terrains and limited construction land, buildings generally adopted techniques such as stilted buildings (Diao Jiao Lou) and staggered terrace foundations to cleverly resolve elevation contradictions. This transformed the disadvantage of vertical terrain into the advantage of horizontal commercial interfaces, achieving a spatial expansion strategy of "occupying sky without occupying land." In terms of functional organization, vertical zoning models such as "shops in front, residences in back," "shops downstairs, warehouses upstairs," and even "multi-story composites" became mainstream. Building facades widely employed detachable row door panel systems, allowing indoor and outdoor spaces to instantly transform according to day-night cycles and market tides, greatly improving the response efficiency of spaces to traffic flow fluctuations [22]. In addition, the intervention of defensive and connective components such as firewalls and overhead street buildings not only strengthened the continuity of linear spaces but also constructed fire prevention and safety systems adapted to high-density settlements. This comprehensive adjustment from overall texture to single-unit construction profoundly reveals how traffic functions were internalized into the core genes of spatial growth, highlighting the excellent spatial adaptation mechanism and survival philosophy of traditional settlements in a dynamic changing environment [23].

## 5. Case Empirical Research

### 5.1 Zouma Town: Evolution Logic of a Traffic Hub Market Town

Zouma Town stands at the throat of the East Main Road of the Chengdu-Chongqing Ancient Road, located at a key node between Chongqing's main city and Bishan. Since ancient times, it has been the "First Station into Chongqing" and an important gateway for land routes out of Sichuan. As a core post station in the Ming and Qing post transmission system, the town was not only a necessary passage for document transmission and official travels but also undertook the hub function of material distribution and traveler transit in eastern Sichuan, serving as a strategic fulcrum connecting the Sichuan-Chongqing economic corridor. Its site selection ingeniously utilized hilly gentle slope terraces, avoiding flood disasters while ensuring smooth roads, reflecting precise adaptation to natural terrain. The convergence of high-frequency human and material flows prompted its evolution from a single traffic node into a regional commercial center radiating to the surroundings, providing a typical sample for studying the spatial adaptability of traffic hub market towns.

The spatial morphology evolution of Zouma Town was tightly coupled with the periodic fluctuations of ancient road traffic flow, presenting a clear trajectory of growth from a linear post road to a composite market town. During the peak of the Ming and Qing dynasties, to cope with surging logistics, the settlement stretched violently along the main street axis, forming a "fishbone" road network structure. Street sections accommodated high-density formats of "shops in front, warehouses in back" by widening main roads and deepening depths. In the mid-to-late Qing Dynasty, with the spillover of commercial functions, the branch alley system perpendicular to the main street gradually densified, connecting wharfs, warehouses, and guild halls, constructing a hierarchical three-dimensional traffic network. After the rise of modern highways, the traffic function of the ancient road declined, and the settlement growth axis shifted. The original linear space gradually solidified into an inward-looking living block. Its morphological texture completely records the decisive impact of traffic mode alternation on settlement spatial reconstruction.

The street and alley system of Zouma Town strictly followed the generation logic of "streets formed by roads, extending with the trend." The main street section presented significant linear extension characteristics. The green stone slab pavement, trampled for a hundred years, formed a slightly concave shape in the middle, which not only reinforced traffic orientation but also constructed a unique rainwater drainage system [26]. Buildings on both sides were mostly two-story Chuan-Dou wooden structures.

### 5.2 Luoquan Town: Evolution Logic of a Commercial-Production Market Town

The rise of Luoquan Town's settlements did not rely solely on transit traffic but was deeply rooted in the local abundant salt brine resources, forming a unique endogenous dynamic mechanism of "town established due to salt, commerce prospered by production." In the Ming and Qing dynasties, with breakthroughs in drilling technology and the implementation of the salt monopoly system, the town rapidly evolved into a core salt production and distribution base in central Sichuan. The huge production and sales network attracted merchants from all directions [18]. The prosperity of the salt economy not only spawned dense groups of well and stove workshops but also drove explosive growth in supporting service industries such as finance, catering, and transportation, prompting a sharp expansion in settlement scale. This economic structure dominated by a single industry profoundly reshaped the functional zoning and spatial order of the market town, making it leap from an ordinary rural settlement into a regional industrial and commercial center radiating to the surroundings, demonstrating the spatial adaptive evolution path of resource-based market towns under specific economic drives.

The spatial layout of Luoquan Town presented distinct characteristics of "integration of production and transport." Salt wells, stove rooms, and storage facilities were densely distributed in strips along both banks of the Zhuxi River, forming a composite spatial texture of "river in front, wells in back, shops downstairs, residences upstairs"[25]. To adapt to the processes of salt brine extraction and boiling, the settlement internally constructed a dedicated traffic network composed of narrow-gauge cart tracks, brine-lifting plank roads, and brine-transporting bamboo pipelines. These productive channels intertwined with public streets and alleys, establishing a road network structure oriented towards production processes. Towering sky cranes, as vertical production nodes, not only defined the skyline but also became the spatial cores organizing surrounding workshop groups. This layout mode, which deeply embedded production facilities into living blocks, maximized the shortening of raw material transport radii, reflecting the spatial extreme optimization of industrial efficiency by commercial-production market towns under conditions of limited land [27].

The spatial characteristics of Luoquan Town are concentrated in the deep embedding of "well-salt production" and "mountainous settlements," forming a unique linear landscape pattern of "five-li long street, one river, two wells." Its street and alley texture did not simply conform to the terrain but strictly followed the technological logic of salt brine transport and finished product export, making the group of sky cranes, brine-transporting bamboo pipelines, and ancient wharfs together constitute a living industrial heritage corridor. This productive landscape not only preserves the spatial integrity of the traditional salt-making process but also witnesses the spatial adaptation wisdom of ancient Sichuan-Chongqing resource-based market towns under the dual drive of traffic and industry. As a rare salt industry ancient town on the Chengdu-Chongqing Ancient Road, its completely preserved workshop clusters and symbiotic community structure provide a precious physical model for studying the evolution mechanism of traditional handicraft settlements, possessing extremely high historical cognition and spatial protection value.

**Summary of Spatial Characteristics:** The space of Luoquan Town is a deep coupling of production processes and geographical environments. Its layout presents production process orientation, functional complexity (production-residence-commerce-transport), and three-dimensional interleaving. Traffic lines (ancient road branches, waterways) were necessary conditions for its development but not the sole reason. Its spatial logic is more complex, resulting from the joint action of resources, technology, traffic, and markets.

### **5.3 Case Comparison and Implications**

The comparison between Zouma and Luoquan vividly reveals the path diversity and mechanism unity of the adaptive evolution of settlement spaces.

**Path Diversity:** Different driving mechanisms lead to different spatial forms. Zouma is "traffic-driven," with spaces presenting a linear service corridor; Luoquan is "resource-industry driven," with spaces presenting a networked production settlement[10].

**Mechanism Unity:** Despite different paths, both profoundly reflect the deep adaptation and efficient response of spatial morphology to dominant functions. Whether serving passing travelers or organizing salt production, their street scales, building layouts, and public node settings have been optimized through long-term practice to achieve efficient operation of core functions at the lowest cost. Meanwhile, when facing the impact of modern traffic changes, both experienced challenges brought by the decline of their original dominant functions, and both gained a "second life" as cultural heritage in contemporary times due to their well-preserved historical spatial textures. The implication for the contemporary era is: to protect and develop traditional settlements, one must first understand their internally and historically formed spatial generation logic and

adaptation wisdom. On this basis, new "dominant functions" conforming to the needs of the times must be found for them to achieve true revitalization and sustainable development [12].

## **6. Dynamic Mechanisms and Contemporary Implications**

### **6.1 Dynamic Mechanisms of Adaptive Evolution**

**Core Interaction Model: Functional Coupling of Traffic and Settlements.** This is the most fundamental driving mechanism. The opening and upgrading of traffic lines enhance the accessibility value of specific locations, attracting population and service aggregation, "inducing" settlement generation and functional development (such as commerce, accommodation). Conversely, the strengthening of settlement functions and scale expansion generate greater traffic demands and service capabilities, "feeding back" into the traffic system, consolidating or even enhancing their line status, and possibly promoting the optimization of local routes. The two form a positive feedback loop. When external traffic modes undergo revolutionary changes (e.g., highways replacing post roads), the original loop is broken, and settlements must seek a new system balance through functional shrinkage, transformation, or spatial reconstruction. This dynamic coupling model of "traffic-function-space" is the main thread for understanding settlement evolution.

**External Drivers: Shaping by Macro-Structural Forces.** National Policies and Systems: The governance strategies of central regimes (such as the Qin-Han commandery-county system, the Ming-Qing post transmission system) directly determined the intensity, routes, and management systems of traffic construction, thereby rigidly prescribing the location (e.g., post station site selection), grade, and basic form of settlements.

**Economic Patterns and Industrial Changes: Regional economic division of labor** (such as salt industry, sugar industry, summer cloth), merchant guild activities, and the formation and changes of market networks determined the type of economic function of settlements (whether traffic hubs, production centers, or markets) and drove their spaces to evolve towards specialization and scaling.

**Technological Changes: From plank road and stone arch bridge technologies to brine-transporting bamboo pipelines, and then to modern highway and railway engineering technologies, every major technological breakthrough broke through terrain limitations, changed traffic efficiency and costs, thereby profoundly affecting the rise and fall, distribution range, and internal structure of settlements.**

**Internal Dynamics: Self-Organization and Regulation of Local Society.** Settlements are not containers passively accepting external influences; their internal social capital and folk wisdom constitute key regulators and buffers.

**Social Self-Organization Ability: Informal organizations such as clans, guilds, merchant groups, and village compacts played key roles in coordinating resource allocation (such as brine distribution in Luoquan), organizing public construction (such as building roads and bridges), and managing community affairs (such as fire prevention and security). This collective action ability based on common interests and rules is the social foundation for settlements to respond to external changes and achieve internal adjustment.**

**Folk Construction Wisdom: The low-tech, applicable technical systems accumulated by local craftsmen and residents in long-term practice, which coordinate with the natural environment (such as Chuan-Dou structures, stilted buildings, courtyard ventilation, drainage and flood control treatments), enable settlement spaces to flexibly adapt to complex terrains and climates at lower costs, demonstrating strong physical resilience.**

**Incremental Renewal and Functional Replacement: In the face of decline, residents spontaneously carry out small-scale, incremental renovations and reuse of spaces, such as converting street-front shops into**

residences, developing old courtyards into homestays, or opening ancestral halls as cultural activity centers. This "bottom-up" micro-renewal is the intrinsic source of vitality for settlements to continue their lives.

## **6.2 Implications for Contemporary Protection and Development**

Based on a profound understanding of historical evolution laws and dynamics, this study proposes the following four strategic implications for the contemporary protection and development of the Chengdu-Chongqing Ancient Road and settlements along its line:

**Construct Linear Cultural Heritage Corridors and Implement Holistic Protection.** The isolated thinking of "protecting points individually" must be abandoned. Guided by the theory of "Cultural Routes," the body of the Chengdu-Chongqing Ancient Road, settlements along the line, related historical relics, and natural landscapes should be protected as an indivisible integral system. A cross-administrative collaborative management mechanism should be established to formulate unified protection plans. The core is to restore the continuity of historical spaces: by delineating corridor protection scopes, controlling the cutting of historical corridors by newly built traffic facilities; repairing and marking key ancient road sections; and establishing a unified heritage identification and interpretation system. The goal is to reconnect the scattered "pearls" (individual settlements) with the "golden thread" (ancient road corridor), reproducing their overall value and momentum as a historical corridor.

**Develop Cultural Study Tours and Greenway Tourism to Promote Living Utilization.** The purpose of protection is inheritance and sharing. The rich thematic cultural connotations of the ancient road (post road culture, merchant guild culture, salt industry culture, immigration culture, etc.) should be fully excavated to design in-depth cultural study tour routes and experience projects. Simultaneously, combining the beautiful mountainous and hilly scenery with the needs of rural revitalization, ancient road remains should be integrated with the construction of rural trails and bicycle lanes to create a Chengdu-Chongqing Cultural Heritage Greenway. Allow tourists to immersively experience the historical environment through slow travel modes such as hiking and cycling. The key lies in guiding local communities to deeply participate in tourism services (such as homestays, catering, tour guiding, handicraft displays), ensuring shared development benefits and avoiding damage to authenticity caused by excessive commercialization, thereby achieving "promoting protection through utilization."

**Creatively Apply Traditional Wisdom in Rural Revitalization.** The adaptive wisdom of traditional settlements, tested over thousands of years, has excellent reference value for today's rural construction. This is not just about borrowing forms like "Chuan-Dou houses" or "small green tiles," but learning their ecological adaptation concepts (following the mountain trend, saving arable land, using local materials), spatial organization strategies (functional mixing, compact layout, public nodes), and social co-construction mechanisms. In new rural planning, traditional village renovation, and rural industrial development, these wisdoms should be deeply studied and transformed to solve problems faced by modern villages, such as improving living environments, arranging industrial spaces, and strengthening community cohesion, walking a path of rural revitalization with cultural roots, regional characteristics, and sustainability.

**Practice the "Cultural Route" Development Concept to Promote Regional Synergy.** Actively integrate the protection and activation of the Chengdu-Chongqing Ancient Road cultural line into regional development strategies such as the construction of the "Chengdu-Chongqing Twin City Economic Circle" and the Bashu Cultural Tourism Corridor. Through the creation of cultural lines, not only can cultural heritage be protected, but also the economic development, infrastructure improvement, and ecological protection of underdeveloped

areas along the line can be promoted. Planning should systematically consider functional complementarity on the line: different settlements can undertake differentiated functions such as cultural experience, ecological vacation, artistic creation, and characteristic agriculture based on their own characteristics. The ultimate goal is to let this ancient channel rejuvenate in the new era, becoming an important bond for promoting regional cultural identity, economic growth, and social harmony.

## 7. Conclusion

Through a systematic investigation of the traffic change history of the Chengdu-Chongqing Ancient Road and the spatial evolution of traditional settlements along its line, this study draws the following core conclusions:

First, the transformation of traffic modes is the most basic and most continuous core driving force driving the spatial evolution of settlements along the Chengdu-Chongqing Ancient Road. Every replacement from post roads to highways and railways directly led to the re-evaluation of settlement location values, the reorganization of functional structures, and the adjustment of spatial morphologies. Its influence permeates the entire life cycle of settlements from incubation, development, to transformation.

Second, the evolution of settlement spaces presents clear staging, regularity, and adaptability. The process can be divided into four stages: incubation, development, maturity, and decline/transformation. Their distribution shows strong linear dependence and equidistant distribution laws. Their internal structures, building types, and node settings all reflect deep adaptation and efficient organization towards traffic functions, economic life, social structures, and natural environments. The case comparison between Zouma Town and Luoquan Town further confirms the diversity and internal unity of settlement spatial adaptation strategies under different dominant function drives.

Third, the adaptive evolution of settlements is a result of multi-factor compound action. It stems not only from the core mechanism of "traffic-function" interaction but is also profoundly shaped by external macro-forces such as national policies, economic industries, and technological innovations. Moreover, it relies on the key regulation of internal dynamics such as local social self-organization abilities, folk wisdom, and incremental renewal. It is precisely the synergy of these internal and external dynamics that endows traditional settlements with systemic resilience and innovative potential to cope with changes.

Finally, historical wisdom illuminates the path forward. This study believes that contemporary interventions in the Chengdu-Chongqing Ancient Road and settlements along its line must be based on full respect for the aforementioned historical laws. The direction of future work should unswervingly move towards holistic protection, living inheritance, and coordinated development. By constructing linear cultural heritage corridors, developing cultural study tours and greenway tourism, applying traditional wisdom in rural revitalization, and practicing regional cultural route concepts, it is entirely possible to transform this precious historical heritage from a mere "fossil" state into living cultural resources that empower the present, benefit people's livelihoods, and nourish the future, continuing a new chapter in the urban and rural development of the new era.

This study also has some limitations. For instance, the restoration of early settlement forms before the Ming and Qing dynasties is limited by historical materials; the coverage of case studies can be further expanded to more types of settlements; and the excavation of the correlation between non-material socio-cultural factors (such as folk beliefs, oral traditions) and spatial evolution can be deepened. Looking ahead, research can further utilize digital humanities technologies such as big data and 3D modeling to build more refined settlement spatiotemporal databases and evolution simulation models; place the Chengdu-Chongqing Ancient Road in a

national or even global linear cultural heritage network for comparative studies; and continuously track and evaluate the implementation effects of various protection and development strategies, thereby constantly improving the theoretical system and practical path of linear cultural heritage protection and activation, contributing academic strength to continuing the historical vein of Chinese civilization and building a modern civilization of the Chinese nation.

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With a calm and meticulous disposition, she excels in coordinating and advancing team projects while also being capable of conducting in-depth research and developing creative proposals independently. Looking ahead, she aspires to contribute to the optimization of urban and rural environments from a professional perspective, practicing sustainable design principles to achieve mutual growth of personal and societal value.