Research on the Construction of the Tang-Tibet Ancient Road (Qinghai Section) Heritage Corridor from the Perspective of Cultural Ecology

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Abstract: In the context of advancing the construction of the Belt and Road, the preservation and perpetuation of the Tang-Tibet Ancient Road holds immense significance in promoting development in the Western region. The Qinghai section, with its abundant cultural heritage, has emerged as the focal point for the cultural preservation. However, the current development and preservation efforts lack a comprehensive analysis and evaluation of heritage resources. This paper takes a cultural ecology perspective as its starting point and conducts a comprehensive survey of existing natural and cultural heritage sites along the Ancient Road. Additionally, it utilizes spatial analysis tools to analyse the accessibility and suitability of the corridor space. Ultimately, this paper constructs a cohesive cultural heritage corridor for the Tang-Tibet Ancient Road.
Keywords: Tang-Tibet Ancient Road, heritage corridor, cultural ecology, linear cultural heritage

1. Introduction

In the era of globalization and modernization, the preservation and transmission of cultural heritage are increasingly receiving extensive attention from the international community. As a carrier of human history and civilization, cultural heritage not only has profound historical, artistic and scientific values, but also serves as a symbol of the spirit of a country. Nevertheless, the development of urbanization has resulted in the continued monolithic and isolated mode of conservation of the majority of cultural heritage[1]. Consequently, the effective safeguarding and transmission of cultural heritage have emerged as a pressing contemporary concern.

Cultural ecosystems are integrated systems in which people and culture, culture and nature, and culture and society are closely linked[2]. It focuses on the relationship between culture and the natural ecology in which it is located and its changes[3]. It emphasizes the organic interaction between humans, culture and the physical environment. The concept of heritage corridors was first proposed by American scholars as a strategic approach to the overall protection of regional historical and cultural heritage and its natural environment[4]. The construction of heritage corridors emphasizes ecological integrity and cultural heritage continuity, connecting natural landscapes with cultural heritage, while integrating recreational, educational, aesthetic and other functions [5]. This integration enables the historical and cultural heritage to be integrated with regional spatial characteristics.

The Tang-Tibet Ancient Road, an ancient route connecting the Central Plains with Tibet, has been witness to numerous significant historical events in Chinese history. As a significant component of the Tang-Tibet Ancient Road, the Qinghai section encompasses a multitude of historical artefacts, ethnic settlements and natural landscapes along the route. Nevertheless, in the context of changing times and external environmental factors, these cultural heritages confront a multitude of challenges and threats.

This paper adopts a cultural ecology perspective to delve deeply into the theory and implementation of heritage corridor construction. It explores the profound cultural significance of the Tang-Tibet Ancient Road and delineates a potential heritage corridor space with the technical assistance of ArcGIS 10.8. Ultimately, it constructs a heritage corridor of the Tang-

Tibet Ancient Road. The objective is to promote the protection and inheritance of heritage resources along the Tang-Tibet Ancient Road.

2. Overview of the Qinghai section of the Tang-Tibet Ancient Road and basic data

2.1 Overview of the study area

The Tang-Tibet Ancient Road stretches for over 3,000 kilometers, traversing five provinces including Shaanxi, Gansu, Qinghai, Sichuan, and Tibet, with the Qinghai segment constituting more than half of its total length. After reviewing a large amount of data to sort out the route of the Tang-Tibet Ancient Road within the territory of ancient Qinghai [6-8], the specific scope of this study encompasses administrative regions such as Minhe Hui Autonomous County, Ledu District, Huzhu Tu Autonomous County, Ping'an District, Xining City, Huangyuan County, Gonghe County, Xinghai County, Maduo County, Chengduo County, Yushu City, as well as Zaduo County(Figure 1).

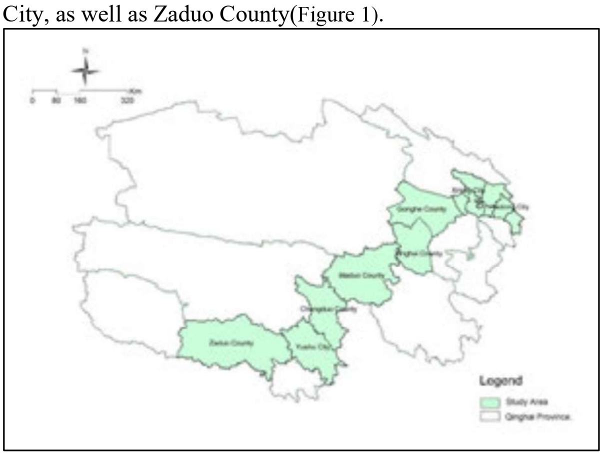


Figure 1 Study Area

The Qinghai section of the Tang-Tibet Ancient Road is an integral and significant component of the route. Its rich natural and cultural heritage serving as an evidence to the grandeur of ancient civilization and the harmonious cultural exchange between Chinese and Tibetan peoples [9]. The Qinghai section of the Tang-Tibet Ancient Road is indelibly marked by the interdependence of its millennia-old cultural heritage and ecological environment.

2.2 Data sources

The data required for the study include: (1) DEM digital elevation data and land use type data of the study area in 2022, obtained from the Geospatial Data Cloud of the Chinese Academy of Sciences (http://www.gscloud.cn); (2) Information on cultural and natural heritage sites, such as cultural relics protection units, traditional villages and scenic spots at all levels, obtained from the cultural and tourism bureaus of prefectures and municipalities in Qinghai; (3) Road traffic and water system data obtained from the Open Street Map platform (https://www.openstreetmap.org/); (4) POI data of public service facilities, such as restaurants, hotels and car parks, obtained from the Baidu Map platform.

3. Research Ideas and Methods

3.1 Research ideas

This paper aims to establish a comprehensive and scientifically sound heritage corridor for the Tang-Tibet Ancient Road. We employ the Analytic Hierarchy Process to quantitatively evaluate and classify the natural and cultural heritage resources. Then, the spatial distribution of heritage resources at all levels was analyzed using GIS kernel density. A comprehensive resistance surface was created to conduct in-depth research on spatial resistance patterns related to corridor construction. A potential Tang Tibetan ancient road heritage corridor network was identified and constructed using cost connectivity tools. Finally, considering environmental sustainability and the preservation of cultural diversity, we propose a heritage corridor protection strategy that integrates macro-strategic considerations with the micro-level requirements of urban development. This strategy aims to foster the overall rejuvenation and enduring prosperity of the Tang-Tibet Ancient Road region.

3.2 Research methodology

The advancement of science and technology has significantly propelled the innovation of heritage resource research methods. Approaches, such as the Analytic Hierarchy Process (AHP), Kernel Density Analysis (KDE), and Minimum Cumulative Resistance model (MCR), have gained widespread adoption among international scholars for conducting in-depth investigations and establishing heritage corridors.

The Analytic Hierarchy Process (AHP), originally introduced by Thomas L. Saaty in the 1970s, is a multi-criteria decision analysis technique that integrates qualitative and quantitative aspects. In the context of heritage assessment, it effectively constructs a hierarchical model of heritage value by establishing a quantitative weighting system through the comparison of varying indicator importance levels[10]. This study incorporates ecological indicators, emphasizing the significance of heritage within the ecological environment and its harmonization with the surrounding landscape to ensure the symbiotic growth of culture and ecology during corridor development. Despite its value, a notable limitation of this method lies in its subjectivity, where expert opinions can influence decision outcomes. To address this concern, 12 experts with relevant backgrounds are engaged in independent evaluations to uphold the objectivity and scientific rigor of the assessment results.

To reveal the spatial heritage distribution pattern and pinpoint heritage concentration zones, scholars globally have increasingly integrated Kernel Density Analysis (KDA) into heritage research. This non-parametric spatial analysis method involves the construction of judgment matrices, computation of weight vectors, and consistency assessments [11]. Within heritage corridor construction, KDA accurately assesses the spatial clustering intensity of heritage sites, aiding in the identification of pivotal corridor nodes and the optimization of spatial layout. The formula is as follows:

$$f_n(x) = \frac{1}{nh}\sum_{i=1}^{n} K\left(\frac{x-x_i}{h}\right) \quad (1)$$

Where n is the number of points included in the threshold range; h is the threshold value; $x-x_i$ denotes the Euclidean distance between two points; K is the kernel function, the larger the value indicating that the distribution of the points of the element is more intense.

In the pursuit of comprehensively establishing the Tang-Tibet Ancient Road Heritage Corridor within the current Qinghai Province landscape, this study adopts the Minimum Cumulative

Resistance model (MCR) proposed by Knaapen in 1992[12] . The MCR model, leveraging diverse resistance factors like topography, rivers, and transportation, determines the path of least resistance for heritage resource dissemination, consequently delineating priority zones for corridor development. The model formula is as follows:

$$MCR = f_{min} \sum_{j=n}^{i=m} (D_{ij} \times R_i) \tag{2}$$

Where Dij denotes the spatial distance of the tourist from environmental element i to heritage site j; R_i denotes the resistance value of the surface suitability of space i; ∑ denotes the cumulative resistance that the tourist must overcome to reach the heritage site, and f_{min} is the value of the minimum cumulative resistance.

A multidisciplinary and multi-dimensional approach serves as a critical foundation for constructing the Tang-Tibet Ancient Road heritage corridor. Hierarchical analysis efficiently evaluates heritage site values, kernel density analysis vividly depicts heritage site distributions across all levels, and the MCR model assesses suitable corridor construction areas based on present conditions. Therefore, the integration of diverse disciplines has become imperative for crafting a scientific and comprehensive heritage corridor.

4. Construction of Heritage Corridor of Tang-Tibet Ancient Road (Qinghai Section)

4.1 Comprehensive Heritage Assessment and Grading

4.1.1 Classification and Evaluation of Heritage

Through field research and consultation of pertinent reports, all cultural and natural heritage sites within the study scope were meticulously cataloged, encompassing cultural heritage conservation sites at various levels, renowned towns and villages, industrial heritage sites, amounting to a total of 365 resource points. In accordance with the guidelines outlined in the Convention for the Protection of the World Cultural and Natural Heritage concerning Cultural and Natural Heritage, the evaluation of cultural heritage should encompass its historical, artistic, and scientific significance, while the evaluation of natural heritage should consider its artistic aesthetics and scientific value. In alignment with the criteria for heritage corridor development and the distinctive attributes of the heritage sites along the Tang-Tibet Ancient Road, this study formulates a comprehensive heritage value assessment framework based on five dimensions: Historical Value, Social Value, Artistic Value,Natural Landscape Value, and Economic Value [13-14]. Subsequently, an assessment and grading process for heritage resources is conducted. Given the varying significance of each evaluation criterion and factor in heritage value assessment, this research undergoes multiple evaluations by a panel of 12 scholars and experts to ascertain the relative weight of each factor meticulously.

The evaluation adopts the combination of expert evaluation method, tourist survey method and professional survey method. Relevant experts are invited to evaluate factors such as "relevance to the ancient road" and "tourism development potential". Tourists and residents are invited to evaluate factors such as "visibility" and "emotional recognition by residents". Other quantitative factors such as "historical longevity" and "level of protection" are evaluated through data.

Table 1 Assessment Table of Heritage Value

Evaluation Type	Evaluation Factors	Categorical Indicators	Scoring Criteria	Weight(%)

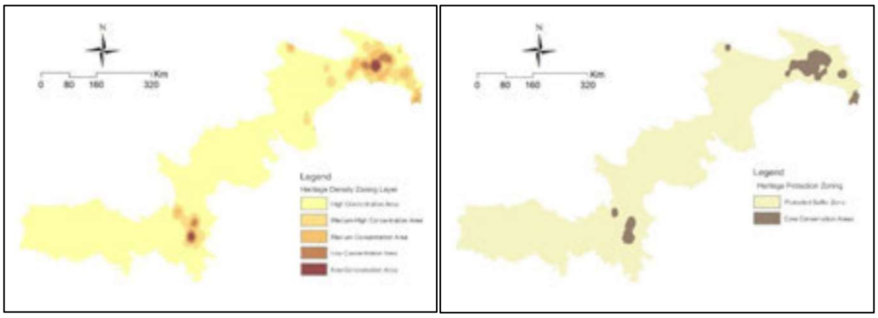
Historical Value	Historicity	Before the Tang Dynasty (Before 618)	5	40%
		Tang dynasty (618-907)	4	
		Song (960-1129) and Yuan Dynasty (1271-1368)	3	
		Ming (1368-1644) and Qing (1644-1912) Dynasty	2	
		Modern Times (Since 1921)	1	
	Grade of Protection	World-class	5	30%
		National	4	
		Provincial	3	
		municipal	2	
		Unrated	1	
	Relevance to the Ancient Road	Very high	5	30%
		High	4	
		Relatively high	3	
		Average	2	
		Relatively low	1	
Social Value	Popularity	World-renowned	5	40%
		Nationally renowned	4	
		Provincially renowned	3	
		City and county renowned	2	
		Little known	1	
	Resident Emotional Identification	Very high	5	30%
		High	4	
		Relatively high	3	
		Average	2	
		Relatively low	1	
	Educational and Research Value	Very high	5	30%
		High	4	
		Relatively high	3	
		Average	2	
		Relatively low	1	
Evaluation Type	Evaluation Factors	Categorical Indicators	Scoring Criteria	Weight(%)
Artistic Value	Artistic Rarity	Rare in the world	5	50%
		Rare nationwide	4	
		Rare in the province	3	
		Rare in the city	2	
		Common	1	
	Preservation Integrity	Preserved Completely	5	30%
		Partially Damaged	4	
		Majority Damaged	3	
		Heavily Damaged	2	
		Disappeared	1	
	Aesthetic Appreciation	Very high	5	20%
		High	4	
		Relatively high	3	
		Average	2	

		Relatively low	1	
Natural Landscape Value	Ecological Importance	Very Important	5	35%
		Important	4	
		Moderately Importan	3	
		General importance	2	
		Unimportant	1	
	Grade of Natural Landscape Protection	National Protected Area	5	35%
		Provincial Protected Area	4	
		Municipal/County-level Protected Area	3	
		Proposed Protected Area	2	
		Regular Landscape	1	
	Landscape Coordination	Very high	5	30%
		High	4	
		Relatively high	3	
		Average	2	
		Relatively low	1	
Economic Value	Economic Contribution	Very high	5	40%
		High	4	
		Relatively high	3	
		Average	2	
		Relatively low	1	
	Tourism Development Potential	Very high	5	30%
		High	4	
		Relatively high	3	
		Average	2	
		Relatively low	1	
	Transportation Accessibility	Very Convenient	5	30%
		Relatively Convenient	4	
		Moderately Convenient	3	
		Inconvenient	2	
		Highly Inaccessible	1	

According to the heritage value assessment table in Table 1, 365 heritage sites were assessed, and the weighted formula was used to calculate the overall value of each heritage site. A total of 110 heritage sites with a score of 3.50-5.00 were finally identified as Grade I heritage sites; 119 heritage sites with a score of 2.50-3.50 were identified as Grade II heritage sites; and 136 heritage sites with a score of 1.00-2.50 were identified as Grade III heritage sites.

4.1.2 Spatial Classification of Heritage based on Kernel Density Analysis

Based on the evaluation and classification results of heritage sites, the spatial distribution pattern of heritage sites at all levels was explored by the kernel density analysis method. Three kernel density layers were superimposed by the weighted superimposition technique with weights of 3, 2 and 1. The distribution density and importance of different heritage sites were comprehensively evaluated, and the areas of high aggregation, medium-high aggregation, medium aggregation, low aggregation and non-aggregation of heritage sites were identified (Figure 2a). According to the results, areas with a value of more than 326.35 were identified as core conservation areas, mainly located in Xining City, Haidong City and Yushu City. There have rich natural and cultural heritage and important conservation values, and are important nodes of the heritage corridor. The rest of the area is used as a buffer zone for conservation, where heritage resources are more dispersed, and as a secondary area during the construction of the corridor(Figure 2b).



(a) (b)

Figure 2 (a) Heritage Density Zoning Layer and (b) Heritage Protection Zoning Layer

4.2 Analysis of the Suitability of the Tang-Tibet Ancient Road Heritage Corridor

4.2.1 Construction of Single-Factor Resistance Surface

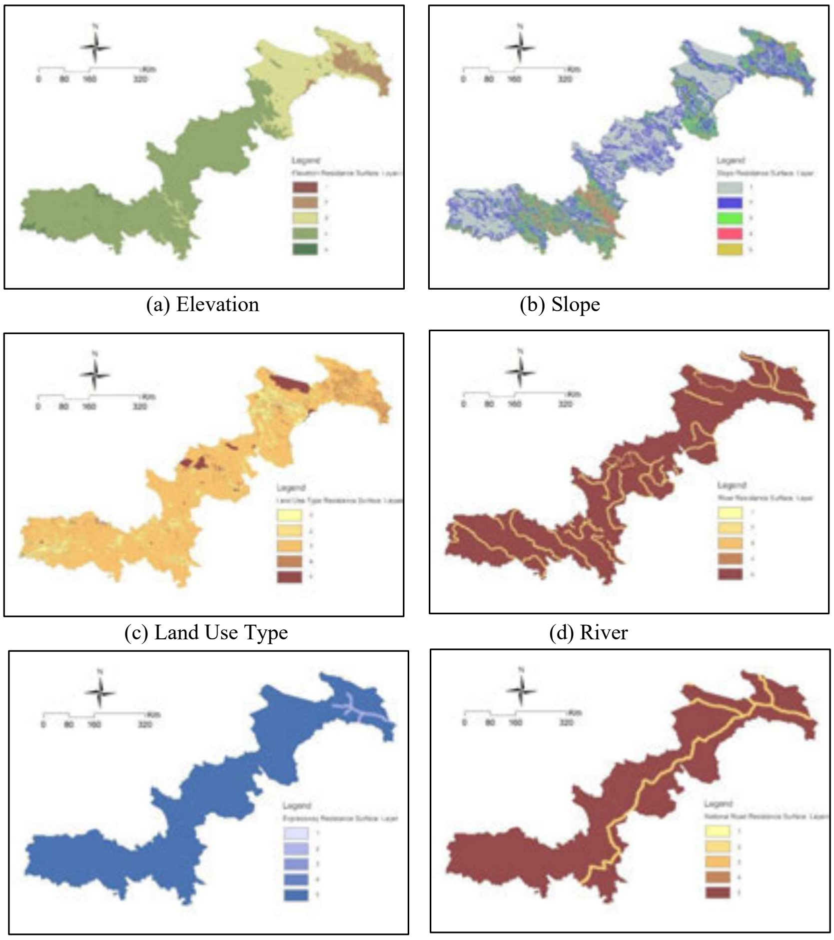
Based on considering the cultural ecological analysis framework comprehensively, the Analytic Hierarchy Process (AHP) method is used to allocate the weights of influencing factors. In Table 2, this study draws on existing research findings to identify and determine 10 key resistance factors in heritage corridors from three dimensions: natural environment, transportation network, and public services. The lower the score, the smaller the resistance, and the more suitable it is for corridor planning [15].

Table 2 Score and weight of resistance factors

Indicator Type	Resistance Factor	Categorical Indicators	Evaluation	Weight
Natural Environment	Elevation	1500	1	0.12
		2750	2	
		4000	3	
		5250	4	
		>5250	5	
	Slope	3	1	0.16
		8	2	
		15	3	
		25	4	
		>25	5	
	Land Use Type	Unused Land	1	0.22
		Developed Land	2	
		Forest and Grassland	3	
		Farmland	4	
		Waters	5	
	Distance from River	300	1	0.10

		300-800	2	
		800-1500	3	
		1500-3000	4	
		>3000	5	
Transport	Distance from Expressway	<500	1	0.8
		500-1500	2	
		1500-3500	3	
		3500-6000	4	
		>6000	5	
	Distance from National Road	<500	1	0.6
		500-1500	2	
		1500-3500	3	
		3500-6000	4	
		>6000	5	
	Distance from Provincial Road	<500	1	0.4
		500-1500	2	
		1500-3500	3	
		3500-6000	4	
		>6000	5	
Public Services	Dining and Accommodation	>900	1	0.10
		488-900	2	
		180-488	3	
		32-177	4	
		<32	5	
	Parking Lot	>1200	1	0.6
		700-1200	2	
		280-700	3	
		48-280	4	
		<48	5	
	Service Area	>52	1	0.4
		30-52	2	
		15-30	3	
		4-15	4	
		<4	5	

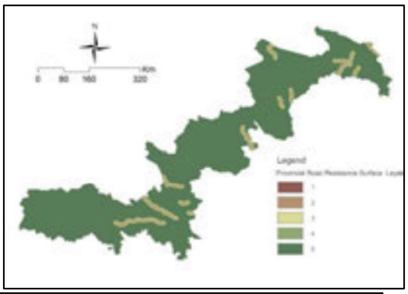
At the natural environment level, based on the principle of harmonious coexistence between human activities and the ecological environment, three resistance factors were selected: Elevation, Slope, and Land Use Type[16]. The higher the elevation and the greater the slope, the higher the resistance value, and the resistance value of regional land use type with more convenient human activities is smaller. At the transport network level, the distance to rivers and roads was selected as the key resistance factor [17]. At the level of the public service system, the distribution of service facilities such as dining and accommodation, parking Lots, and service areas were analyzed by the nuclear density tool, and areas with a high-density value can bring a better experience and feeling to tourists [18]. Finally, based on the weight and value of each resistance factor, the single-factor resistance surface of heritage corridor construction is generated (Figure 3).

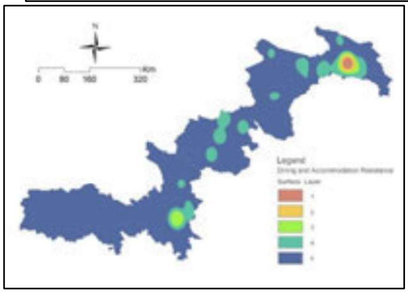


(a) Elevation (b) Slope

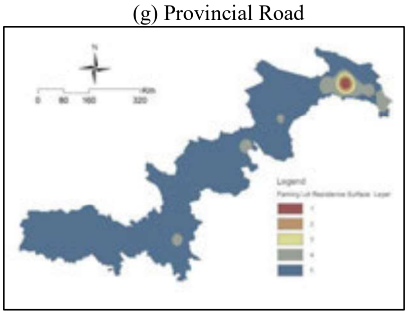
(c) Land Use Type (d) River

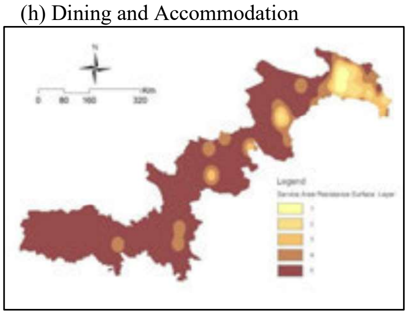
(e) Expressway (f) National Road





(g) Provincial Road (h) Dining and Accommodation





(i) Parking Lot (j) Service Area

Figure 3 Single-factor Resistance Surface resistance surface

4.2.2 Corridor Suitability Analysis

Using the ArcGIS raster calculator tool, 11 single-factor resistance surfaces were overlaid according to the specified resistance factor weights to construct a comprehensive resistance surface model that comprehensively reflects the resistance distribution in different areas of the study area. Based on this layer, the natural breakpoint method was employed to categorize the comprehensive resistance surface into five distinct classes of suitability zones: High Suitability Area, Moderately High Suitability Area, Medium Suitability Area, Low Suitability Area, and Unsuitable Area [19] (Figure 4). The area centered on Xining City is a high suitability zone, indicating that the heritage in this area has a high suitability and accessibility, and therefore a greater advantage in the construction of the Tang-Tibet Ancient Road heritage corridor. This suitability classification offers valuable guidance for formulating tailored protection and development strategies for different regions, thereby facilitating the scientific preservation and sustainable utilization of the cultural and natural heritage along the Tang-Tibet Ancient Road.

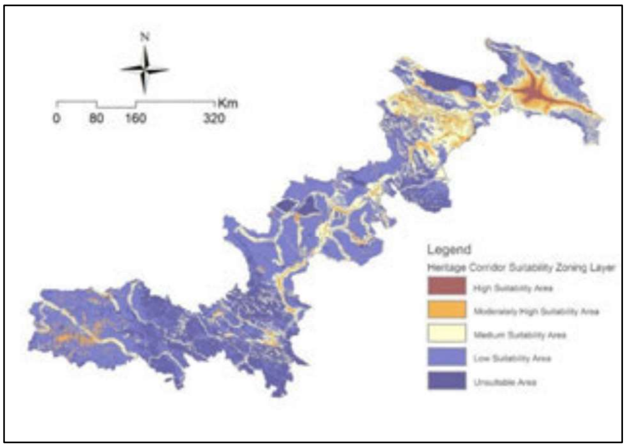


Figure 4 Heritage Corridor Suitability Zoning Surface

4.3 Construction of Tang-Tibet Ancient Road Heritage Corridor

4.3.1 Generation of Potential Heritage Corridors Along the Tang-Tibet Ancient Road

Based on the analysis of the distribution of comprehensive resistance zones in the Tang Tibet Ancient Road Heritage Corridor, using cost connectivity tools, accurately identify and generate the path with the lowest resistance between each heritage point. These paths simulate the direction of the potential corridor of Tang Tibetan ancient road cultural heritage, showing a clear east-west linear direction and densely distributed in the cultural core area (Figure 5). After a rigorous comparison and analysis of the simulation results in relation to the current river and motorway networks, it was found that these infrastructures are mainly built along national and provincial roads. They efficiently connect the region's historical relics and natural landscapes, demonstrating a deep respect for the preservation of cultural heritage and a balanced approach to natural ecology.

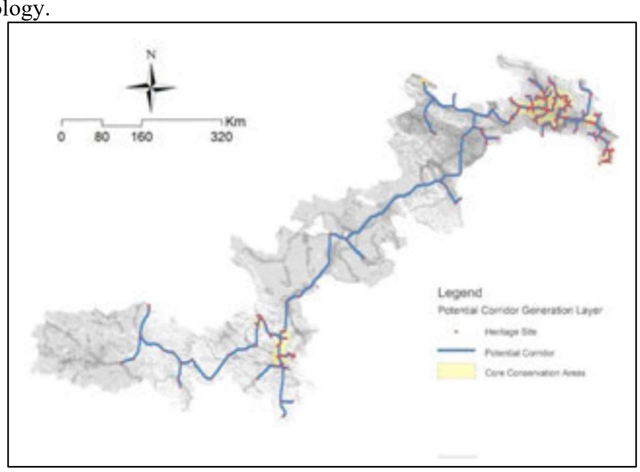


Figure 5 Potential Corridor Generation

Based on the potential of this heritage corridor, a comprehensive Tang-Tibet Ancient Road Heritage Corridor will be established. This corridor will integrate heritage protection, ecological restoration and cultural exhibition, ensuring the sustainable development of the region while safeguarding its rich cultural and natural assets.

4.3.2 Construction of Service Station in Heritage Corridors

The Tang-Tibet Ancient Road heritage corridor's functional integrity is reflected in the protection and display of culture, as well as in the provision of high-quality tourism services. Taking into account the distribution density of heritage and potential corridors, the construction of a corridor service station that integrates tourist rest, cultural exchange, and style display can effectively improve the public service level of heritage corridors. The service station should be situated in areas along the tourist route with a high concentration of tourists, distinctive cultural characteristics, or a limited distribution of heritage resources (Figure 6). The service station of the corridor undertakes the concentration and diffusion of information and functions on the route [19], enhancing the overall coherence of the heritage corridor and further enhancing the overall value and attractiveness of heritage resources in these areas.

4.3.3 Development of specialized tourism routes

Based on the cultural characteristics and protection priorities of the heritage site, construct characteristic tourism routes along the Tang Tibetan ancient road. These routes should include three types: Historic Relic Route, Cultural Experience Route, and Natural Scenery Route [20] (Figure 6).

The route of historical relics is mainly based on core protected areas, which are the areas with the most concentrated heritage and have a large amount of high-value natural and cultural heritage. To enhance the cultural experience of the heritage corridor, rich natural and cultural heritage is linked together through route planning and design while organizing tourists to participate in traditional festivals, handicraft production, and ethnic song and dance performances.

The cultural experience routes are primarily distributed in areas with a relatively low heritage density near the core area. To enhance the coherence and richness of the routes, scientific and technological means can be employed to restore or recreate heritage sites that have been lost or destroyed and integrate them with cultural experience areas such as cultural museums and exhibition spaces.

The main goal of the natural scenery route is to strengthen the connection of each cultural core area. The distribution density of cultural heritage points on this route is relatively low, mainly concentrated in displaying natural heritage and ecological landscapes. By developing and utilizing the natural landscape resources along the route, create a heritage corridor tourism route that simultaneously develops and balances culture and ecology.

4.3.4 Heritage Corridor Interpretation System Construction

The Tang-Tibet Ancient Road embodies a cultural heritage spanning over three thousand years, with its historical value and cultural connotations remaining ever-fresh and enduring. The interpretation system is an effective way to promote and inherit the historical wealth of the Tang Tibetan ancient road heritage corridor. It can effectively convey historical and cultural information, enrich tourism experiences, promote cultural dissemination and exchange, and achieve the continuity of historical and cultural heritage. Based on the corridor tourist routes and "service stations", the cultural connotation and historical value of the heritage resources in the corridor are conveyed to tourists by means of diversified display methods such as historical images and stories [21].

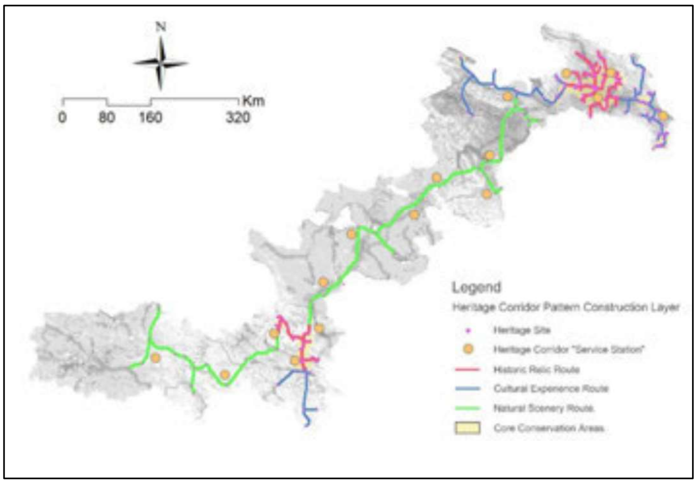


Figure 6 Heritage Corridor Pattern Construction

5. Heritage Corridor Protection Strategy for the Tang-Tibet Ancient Road (Qinghai Section)

To provide a comprehensive and effective protection framework for heritage resources, this paper combines the principles of cultural ecology and focuses on the interconnected elements of "point-line-surface", and puts forward the protection strategy of the Tang-Tibet Ancient Road heritage corridor [20].

5.1 Heritage Resource Hierarchy Protection

Heritage sites represent the core components and main contents of the Tang-Tibet Ancient Road heritage corridor, carrying profound historical and cultural values. The protection of individual heritage sites is the most fundamental practice in the overall protection strategy of the cultural heritage corridor. Grading the protection of different heritage sites according to their importance in the composition of the corridor can ensure the rational allocation of resources and promote the sustainable development of the heritage corridor.

Grade I heritage represents the core and soul of the corridor, carrying rich historical information and deep cultural connotations. It is of vital importance to protect its integrity and originality. Further exploration of its historical, cultural and scientific values should be conducted on the basis of ensuring that its body and surrounding environment will not be damaged. As a significant component of the corridor, the protection and perpetuation of secondary heritage is of paramount importance to the integrity of the entire corridor. It is necessary to fully protect it and strengthen its connection with primary heritage to enhance its status in the corridor system and promote the coordinated development of heritage sites. Tertiary heritage is comparatively less significant, yet its stability is conducive to the comprehensive protection of the corridor.

Therefore, it is necessary to implement certain protection measures to ensure the stability of the aforementioned heritage sites and predict and avoid any potential future threats.

5.2 Overall Protection of Heritage Corridor Routes

The protection strategy for the Tang-Tibet Ancient Road heritage corridor should transition from singular heritage sites to encompass the entire route, emphasizing the dual safeguarding of cultural heritage and the natural environment. Aligning with national and urban development plans, this protection should be integrated into the regional coordinated development framework. Strengthened city cooperation and exchanges are crucial to collectively advance corridor preservation, fostering resource sharing and leveraging complementary strengths. Encouraging community involvement and equitable benefit-sharing can enhance residents' engagement, awareness, and accountability in heritage protection, facilitating a harmonious relationship between economic progress and cultural conservation.

5.3 Protection of Cultural Ecosystems in the Corridor Area

The Tang-Tibet Ancient Road (Qinghai Section) Heritage Corridor traverses 12 districts and counties within Qinghai Province, covering an expansive geographic expanse. The varied natural features of mountains, rivers, grasslands, and forests play a pivotal role in shaping and conserving the corridor's cultural heritage, establishing a distinctive cultural ecosystem. In areas such as Xining and Haidong, which are considered the best for corridor development, priority should be placed on protecting heritage and adjacent ecological environments to maintain the historical and cultural wealth of the region. Simultaneously, the interplay between culture and society is advanced through a range of methods, such as the execution of cultural exhibition events and the augmentation of the area's tourism reception capabilities. In regions with limited suitability for corridor construction, such as Zaduo County and Yushu City, initiatives should prioritize the protection of heritage assets while evaluating and preserving key landscapes and ecosystems. Formulating ecosystem protection strategies can bolster stability and resilience, fostering a harmonious coexistence of cultural heritage and ecology by balancing human activities with the natural environment.

6. Conclusion

The Tang-Tibetan Ancient Road (Qinghai section) spans several cities, counties and natural areas, facing the dual challenges of natural factors such as climate, geology and disasters, as well as social factors including historical changes, urban construction and human forgetting. Therefore, its preservation and inheritance face enormous challenges. This paper analyzes the suitability of heritage corridor construction based on the characteristics of natural ecology and historical and cultural heritage protection in Qinghai. A scientific and complete heritage corridor of Tang-Fan ancient road (Qinghai section) is constructed by using GIS platform to calculate and generate potential corridors, combined with "service stations", characteristic tourist routes and corridor interpretation systems. Eventually, the protection strategy is put forward from the three levels of "point-line-surface", which provides support and guidance for cultural heritage protection and tourism development in the Qinghai area.

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Notes

The authors declare no competing financial interest.

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