



Research on Theoretical Methods for Function and Theme Positioning of Mountainous Tourism Highways —A Case Study of the Jiangxi-Anhui Border to Wuyuan Section of the Dezhou-Shangrao Expressway

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Abstract. Amidst the continuous enhancement of China's comprehensive transportation infrastructure and tourism's emergence as a pivotal strategic industry in the national economy, the harmonious integration of transportation and tourism has emerged as a novel trend in the transformation and evolution of traditional economic structures. This study, drawing upon an exhaustive analysis of the concepts and underlying principles of tourism highways, formulates a novel theoretical method for the function and theme positioning of mountainous tourism highways. This methodology integrates theories pertaining to the evaluation of tourism resource values, the highway network layout paradigm of "first-tier rapid transits, second-tier main lines, and third-tier branch lines," alongside tourism market analysis. It is rooted in a meticulous examination of tourism resource characteristics, transportation network conditions, and traveler preferences, coined as "Three Characteristics and One Position." By applying this approach to the Jiangxi-Anhui Border to Wuyuan section of the Dezhou-Shangrao Expressway, the research meticulously analyzes the process and structural framework for function and theme positioning in mountainous tourism highways, thereby offering a robust theoretical foundation for subsequent investigations into the theme positioning of tourism highways.

Keywords: Mountainous areas; Tourism highway; Market; Theory; Theme; Positioning

1 Introduction

Against people's ever-growing aspiration for a better life, the public's approach to tourism is transitioning from mere sightseeing to a more holistic experience. In this paradigm shift, transportation, a cornerstone of the tourism industry, has emerged as a pivotal force, evolving from a mere mode of conveyance to an integral link in the tourism

value chain through creative innovations. The challenge for developers lies in harnessing the potential of highways to capture tourism value, transcending traditional limitations in design, construction, concepts, forms, and functions, and integrating regional resources to underpin holistic tourism^[1]. The theme positioning of highways during the initial planning phase establishes the tone for their functionality and characteristics, directing them to maximize their dual role as both transportation arteries and tourism assets in subsequent operational phases. This, in turn, fosters the proliferation of tourism-related services along highways. Consequently, delving into the construction process of thematic positioning for tourism highways and enhancing theoretical and methodological research on their theme positioning within the holistic tourism context holds paramount significance.

2 Concept Analysis

Drawing from past engineering practices and extensive research, tourism highways are defined as roadways that connect tourist destinations or regions endowed with natural, cultural, recreational, and educational tourism values, while concurrently fulfilling transportation and tourism service functions^[2]. These highways often encompass a comprehensive infrastructure that includes roadways, informative signage, slow-moving lanes, service stations, and eco-friendly landscapes. To effectively intertwine highways with tourism resources and foster the integration of transportation and tourism, determining the theme positioning of tourism highways is imperative. This positioning is guided by principles such as “prioritizing environmental protection and natural harmony,” “demand-driven integrated development,” and site-specific safety considerations,” proceeding within a structured “point-line-area” framework. The “point” aspect entails assessing tourism value, determining the tourism functions and significance of highway nodes through evaluations of tourism resource and corridor landscape values. The “line” aspect involves hierarchical layout optimization, whereby the highway network is refined layer by layer based on node importance, ensuring a more rational tourism highway network configuration. Lastly, the “area” aspect focuses on function positioning, shedding light on highway tourism value, road network layout, and traveler needs to determine the positioning of tourism highway functions and themes, thereby guiding overall planning. Research on the theme positioning of tourism highways offers a fresh theoretical lens for related studies, potentially unleashing new tourism growth points by connecting and activating underutilized scenic areas and sites within regions^[3]. These insights provide invaluable case studies for the practical exploration and development of tourism highways.

3 Theoretical Foundation Research

3.1 Evaluation Methods for Tourism Resource Value

The function positioning of tourism highways commences with the application of evaluation methods for tourism resource value^[4]. Based on the evaluation of resources

along the route, these methods determine whether a highway has the potential to enhance tourism functions, which specific tourism functions can be expanded, and to what extent. Evaluation methods for tourism resource value assess the quality of tourism resources within the project’s impact area, adhering to the standards outlined in *Classification, Survey, and Evaluation of Tourism Resources* (GB/T 18972) and *Classification and Evaluation of the Quality Grades of Tourists Areas* (GB/T 17775). The evaluation focuses on tourism resources, both scenic and non-scenic, within a 20 km radius along the project route, determining the tourism resource value of the project (refer to Table 1).

Table 1. Evaluation contents of tourism resources^{[5] [6]}

Evaluation factor	Description	Result
Scenic resource quality	The presence of 1 or more AAAAA-level scenic areas, 2 or more AAAA-level scenic areas, or 3 or more AAA-level scenic areas within a 20 km radius for every 100 kilometers of roadside	High
	The presence of only AA-level and below scenic areas or non-scenic areas within a 20 km radius for every 100 kilometers of roadside	Low
Non-scenic resource quality	The presence of 1 or more AAAAA-level resources, 2 or more AAAA-level resources, or 3 or more AAA-level resources within a 20 km radius for every 100 kilometers of roadside	High
	The presence of only AA-level resources and below or no resources within a 20 km radius for every 100 kilometers of roadside	Low

Based on the above evaluation, the outcomes of tourism resource value assessment can be categorized into two distinct groups: (1) When the resource quality of scenic and non-scenic areas is exceptional, the value of the project’s tourism resources is correspondingly high; (2) Conversely, if both resources of scenic and non-scenic areas exhibit low quality, the value of the project’s tourism resources is deemed to be low.

3.2 Highway Network Layout of “First-Tier Rapid Transits, Second-Tier Main Lines, and Third-Tier Branch Lines”

The highway network layout approach embracing “first-tier rapid transits, second-tier main lines, and third-tier branch lines” entails determining the hierarchical arrangement through comprehensive resource investigation and analysis, in conjunction with the Analytic Hierarchy Process (AHP). Upon identifying the interconnecting nodes at each tier, the layout progresses in a hierarchical manner. The first tier comprises rapid transits that directly link core tourist hub cities, facilitating swift attraction and congregation of tourists^[7]. This tier emphasizes direct city-to-city connectivity and rational integration of key tourist resources with planned expressways in the vicinity, encompassing major distribution hubs, existing tourist routes, and networks within AAA scenic zones. The optimal configuration assumes a circular structure, as depicted in Figure 1. The second tier, main lines, serves as the arteries between significant scenic attractions, aimed at fostering diverse and seamless travel experiences for visitors. These include main tourist road networks, routes leading to various scenic spots, and leisurely travel

systems. The optimal layout may adopt a “tree-like” pattern, where the “tree” branches effectively distribute traffic from the “ring,” as presented in Figure 2^[8]. The third tier, branch lines, comprises tourist routes (branches) that lead to lesser attractions within the region, geared towards promoting development and attracting tourists. These include roads connecting minor attractions, scenic village thoroughfares, and village paths. The optimal layout leverages a hybrid structure combining “chain-like” and “tree-like” formations, as evidenced by Figure 3.

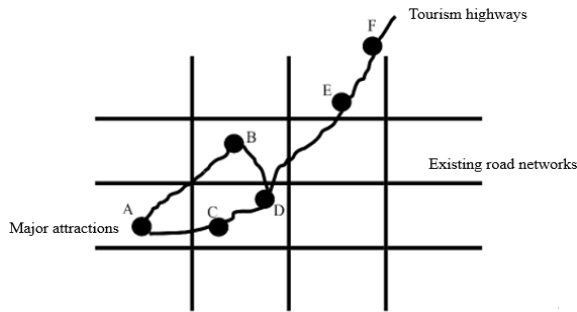


Fig. 1. Layout configuration of rapid transit

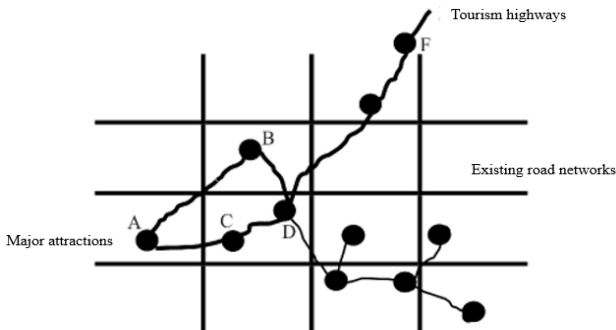


Fig. 2. Layout configuration of main lines

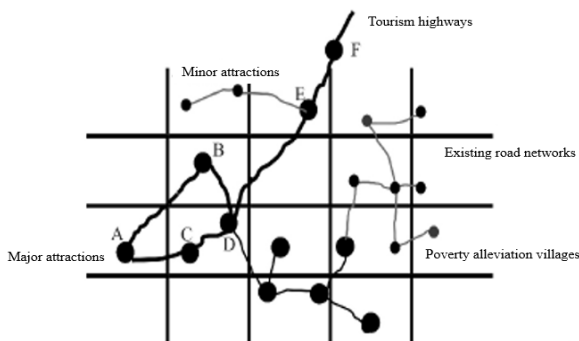


Fig. 3. Layout configuration of branch lines

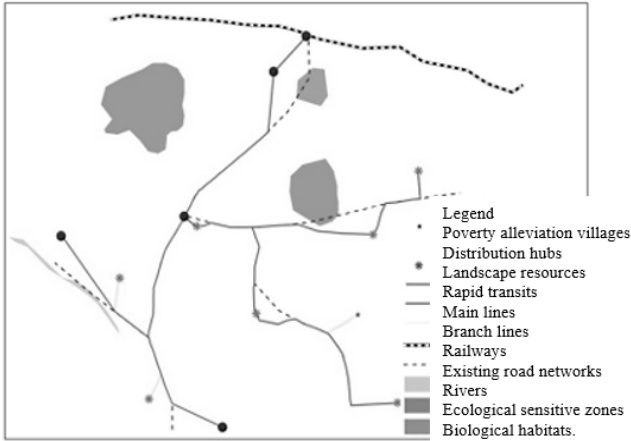


Fig. 4. Planning effect of the tourism highway network layout

Building upon this foundational framework, we employ ArcGIS for spatial analysis and map overlay techniques to systematically integrate various layers such as landscape resource maps, nature reserve distribution maps, ecological function zones, and highway networks, as witnessed in Figure 4. Through iterative optimization at each layer, the initially tree-like tourism highway network evolves into a more interconnected, grid-like structure. This refined network layout not only enhances accessibility but also plays a pivotal role in stimulating regional economic growth.

3.3 Analysis of Tourism Market

The varying regions in which highways are constructed significantly influence the analysis and positioning of the tourism market. By investigating travelers' tourism demands and analyzing the existing source market, we can guide the development of potential customer bases for tourism highways^[9]. This approach allows for the precise expansion, theming, and positioning of the highway's tourism functions. According to related studies^[10], tourists' perceptions of tourism highways exhibit several notable characteristics: (1) Curiosity and desire for knowledge about unique tourism resources: Humans have an inherent curiosity and desire to learn about new or unusual things. Consequently, the unique tourism resources along the highway are highly attractive to tourists, drawing them to explore and understand these features. Thus, when expanding the tourism functions of highways, it is essential to highlight and promote distinctive tourism resources, ensuring that travelers have rich and engaging experiences during their journey. (2) Affinity for special landscape resources: During their travels, tourists are naturally inclined to connect with unique natural and cultural landscapes or high-quality scenic resources along the route. To cater to this desire, it is beneficial to create specific excursion paths from the highway, accessible by bicycles or footpaths, leading to these special scenic spots. This setup enhances the tourists' sense of closeness to the landscape and enriches their overall experience. (3) Demand for convenience and diversity

in along-route services: Most travelers rely on the highway to complete their entire journey. Therefore, they have certain expectations for the ancillary service facilities along the route, which should meet their basic needs by providing food, lodging, shopping, and entertainment options. These facilities must be conveniently accessible, allowing quick and easy access, and they should also offer diverse functions to enable visitors to experience as much local culture and uniqueness as possible within a limited space. (4) Need for rich and accessible travel information: In the age of information, travelers increasingly seek comprehensive travel insights, including weather conditions, parking options, dining recommendations, and the distribution of attractions, as well as real-time information on visitor flow. These data should be not only timely and accurate but also varied and abundant. Hence, in expanding the tourism functions of highways, attention must be paid to the richness, timeliness, and accessibility of tourism-related traffic information.

4 Case Study

4.1 Engineer Overview

The Jiangxi-Anhui Border to Wuyuan section of the Dezhou-Shangrao Expressway (referred to as the “Qimen–Wuyuan Expressway”) is a strategic transportation link nestled in northeastern Wuyuan County, Jiangxi Province—a nationally recognized AAA-level tourist attraction. The highway begins just north of Tuochuan, Wuyuan County, at the Jiangxi-Anhui border, skirting the western fringes of Tuochuan, hugging the eastern edge of Qinghua Town, and then veering westwards past Sikou Town. It crosses the Jiujiang-Quzhou Railway and ends at the Wuyuan Hub, connecting to the Hangzhou-Ruili Expressway. With a total length of approximately 40 kilometers, this route traverses a terrain marked by intricate mountainous and hilly landscapes with a forest coverage rate of around 82%. This expressway links a myriad of key tourism resources, including AAAA-level scenic spots such as Sixi Yancun, Linyandong, and Dazhangshan, as well as other attractions along the northern tourism route. The highway features one service area, one parking area, and three interchanges. An analysis of the existing transportation network and the accessibility of tourist attractions within Wuyuan County (see Table 2) reveals several challenges: (i) The regional tourism transportation network is not yet fully established, the connectivity between developed scenic spots is relatively weak, and most roads are of lower grade; (ii) There is a scarcity of fundamental tourism services along the route, affecting the overall travel experience; (iii) The current system for tourist signage and guidance is insufficient. Scenic spots and attractions are not well-marked, making them difficult for visitors to identify and navigate.

Table 2. Accessibility analysis of tourism roads along the Qimen–Wuyuan Expressway

Along-route highway	Configuration of traffic flow	Coverage of tourism resources	Facility of tourism services

<p>National Highway S303</p>	<p>Average daily traffic flow of 9,476 vehicles, including 1,677 small trucks, 881 medium to large trucks, accounting for approximately 28%; 5,745 small passenger cars, accounting for about 61%; and the remainder consisting of medium to large buses</p>	<p>Wuyuan Scenic Zone of Forestry Birds</p>	<p>Devoid of highway service facilities, it is reliant on roadside accommodations and tourist service points within scenic areas.</p>
<p>Provincial Highway S302</p>	<p>Average weekday traffic flow of 167 vehicles per hour, including 12 heavy trucks, 32 medium and small trucks, and 102 small passenger cars, with buses accounting for 67%</p>	<p>Longteng Gucun, Sixi Yancun Scenic Zone, and Yaowan Scenic Zone</p>	<p>It is reliant on roadside accommodations and tourist service points within scenic areas.</p>

4.2 Tourism Value of Mountainous Tourism Highways

Capitalizing on the methodology for assessing tourism resource value, an evaluation of the tourism resources situated along the Qimen–Wuyuan Expressway has been conducted. The tourist routes in Wuyuan County are predominantly categorized into three primary lines: Eastern, Western, and Northern. This project primarily interlinks the resources along the Northern Tourism Route, encompassing attractions such as Congxi Piaoliu, Sixi Yancun, Caihongqiao, Likengcun, Linyandong Scenic Zone, and Dazhangshan Scenic Zone. Notably, Sixi Yancun, Linyandong, and Dazhangshan are esteemed as AAAA-level scenic spots. The evaluation outcomes indicate that this project boasts a substantial tourism resource value while maintaining a high level of scenic quality.

4.3 Analysis of Mountainous Tourism Highway Network Conditions

Implementing the highway network layout approach of “first-tier rapid transits, second-tier main lines, and third-tier branch lines” to establish the mountainous tourism highway network layout along the Qimen–Wuyuan Expressway involves the following tiers: (1) First-tier rapid transits: The Qimen–Wuyuan Expressway serves as the primary rapid access corridor, enhancing swift dispersion and circulation of visitors. A strategic connecting line is established at the Longteng Service Area, seamlessly linking with provincial highways to ensure precise navigation into scenic areas and addressing the final mile accessibility challenge. By leveraging existing roads surrounding scenic spots and ancient villages as supplementary tourism routes, a convenient and premium-quality transportation network system is forged, optimizing accessibility within the Qimen–Wuyuan Expressway. (2) Second-tier main lines: A comprehensive system of expressways, auxiliary roads, and scenic spots is devised to develop regional attractions. The Qimen–Wuyuan Expressway traverses and interconnects the key attractions along Wuyuan County’s Northern Tourism Route, notably Congxi Piaoliu, Sixi Yancun, and Likengcun. This project establishes a harmonious blend of fast and leisurely

tourism routes, interweaving disparate attractions surrounding the expressway into cohesive and comprehensive tourism itineraries. (3) Third-tier branch lines: A multifaceted system of expressways, auxiliary roads, and unique towns is established to foster rural development across the board. Hinging on the main expressway as the backbone of swift access, strategic interchanges such as Tuochuan, Qinghua Town, and Longteng Service Area, along with the Wuyuan Hub, function as gateways and exit points for auxiliary tourism routes. This framework fosters a comprehensive tourism transportation network along the Northern Tourism Route, embracing distinctive towns like Changshoucun, Jingangling, Qinghua Town, Likengcun, Longtengcun, Sixi Yancun, Xichong, Rencun, and Sikou Town, among others.

4.4 Analysis of Travelers' Demand for Mountainous Tourism Highways

To accurately determine the functions and themes of the mountainous tourism highways along the Qimen–Wuyuan Expressway, we employ the tourism market analysis methods in conjunction with a thorough analysis of travelers' demand. This area in the project boasts a market reach encompassing 10 million individuals, which can be segmented into three distinct levels of tourism markets. The primary customer base comprises leisure-oriented vacationers hailing from the Yangtze River Delta Economic Zone and Poyang Lake Economic Zone, while secondary groups originate from the Beijing–Tianjin–Hebei region, the Yangtze River Delta region itself, and the Southwest Economic Zone. Additionally, a modest yet significant number of international tourists are drawn to the area due to its esteemed reputation. The majority of visitors flock to the region for its renowned attractions, typically staying for 1-2 days, necessitating accommodation arrangements. A notable portion of travelers engage in long-distance journeys, utilizing these locations as pit stops for rest and brief stays. A pristine natural environment and top-notch amenities are paramount among the requirements of these tourists. By and large, the project's target clientele exhibits a youthful demographic, a family-centric orientation, and a preference for short-duration trips. Regarding tourist demographics, a discernible trend emerges towards family-oriented leisure vacations and experiential tourism, particularly among young adults born in the post-1990 and 2000 eras. In terms of travel patterns and timing, weekends and holidays are predominantly utilized for short-distance leisure excursions, with self-driven travel being the preferred mode of transportation.

4.5 Function and Theme Positioning of Mountainous Tourism Highways

Utilizing the “Three Characteristics and One Position” framework, the mountainous tourism highway along the Qimen–Wuyuan Expressway has been strategically positioned with core values that revolve around “delivering a panoramic tourism travel experience, fostering comprehensive tourism radiation drive, providing all-angle tourism travel services, implementing a fully enclosed tourism management mode, and embracing a comprehensive perspective on tourism innovation management.” This highway

serves as the primary conduit, enhancing the tourism radiation reach to encompass the entire Northern Tourism Route of Wuyuan County. This positioning is achieved through the holistic development of tourism infrastructure, highlighted by the establishment of the Longteng Service Area as a comprehensive tourism service hub. Furthermore, a “fast and leisurely tourism” system is implemented, centered on the Qimen–Wuyuan as the central axis. This system integrates seamless transit and distribution services with accommodations, dining, and transportation, creating distinctive tourism products that cater to various traveler needs and preferences.

5 Conclusion

The novel theoretical approach to the function and theme positioning of mountainous tourism highways is grounded in a comprehensive analysis that encompasses the evaluation of tourism value, the layout of the network, and the demands of tourist travelers along these highways, thereby determining their function and theme orientations. Additionally, the hierarchical analysis of tourist highway network layout embraces the approach of “first-tier rapid transits, second-tier main lines, and third-tier branch lines,” culminating in a more scientific and rational layout of the highway networks.

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