Journal of World Architecture, 2026, Volume 10, Issue 5
https://bbwpublisher.com/journal/JWA
Online ISSN: 2208-3499
Print ISSN 2208-3480

Research on the Quality Improvement and Upgrading Design of Road and Bridge Landscapes in the Context of Cultural and Tourism Integration

Haitao Liu, Yijia Wang, Jia Yuan

China Merchants Chongqing Communications Technology Research & Design Institute Co., Ltd., Chongqing 400067, China

Copyright: © 2026 Author(s). This is an open-access article distributed under the terms of the Creative Commons Attribution License (CC BY 4.0), permitting distribution and reproduction in any medium, provided the original work is cited.

Abstract: Against the backdrop of cultural and tourism integration, road and bridge landscape design needs to be upgraded and transformed from its traditionally singular practical function towards cultural and humanistic functions, enabling road and bridge landscapes to serve both as a continuation of regional cultural lineage and as a vehicle for regional cultural tourism promotion. On this basis, taking cultural and tourism integration as the research context, this paper constructs an integrated landscape design approach that incorporates landscape, culture, ecology, and functionality. The paper further proposes a systematic design path for the quality improvement and upgrading of road and bridge landscapes, summarizing specific upgrading design measures from five perspectives: culture, ecology, functionality, nightscape, and operation and maintenance. These measures aim to renew the overall appearance of the road landscape, strengthen cultural empowerment, break the traditional single-dimensional landscape design framework, highlight cultural landmarks of cultural tourism themes, and thereby further enrich the functions of road and bridge landscape design.

Keywords: Cultural and tourism integration; Road and bridge landscape; Quality improvement and upgrading design; Green ecology; Cultural IP

Online publication: November 17, 2026

1. Introduction

In recent years, the efficient development of China's cultural tourism industry has promoted the construction of urban cultural tourism landscapes. As important infrastructure for cultural tourism development and carriers connecting urban landscapes, roads and bridges need to provide cities with more aesthetic and humanistic windows for external display through landscape construction [1]. However, traditional road and bridge engineering in China has paid insufficient attention to landscape design, with most landscapes

presented in the form of greenery, and the cultural symbols incorporated are scattered, lacking planning and overall coherence. Some paint schemes only consider driving safety and are not designed from aesthetic and cultural perspectives, which has weakened the cultural tourism promotional function of road and bridge landscapes. In order to deeply integrate road and bridge landscapes with cultural tourism undertakings in various regions, landscape designers need to combine the features of the entire road section, set up multiple themed segments, implant cultural IP, emphasize regional cultural empowerment, and make full use of various road and bridge facilities to construct an integrated and coordinated landscape design plan [2].

2. Definition of core concepts

2.1. Cultural and tourism integration

Cultural and tourism integration refers to the deep integration of the cultural industry and the tourism industry, thereby achieving the dual effect of using culture to shape the depth of tourism resources and using tourism to showcase cultural characteristics, so as to promote the common development of both industries. At present, in the implementation of cultural and tourism integration across various regions, not only are cultural and tourism resources integrated, but the expressway network is also used as the core connecting carrier. Relying on route planning and traffic node layout, regional culture, natural landscapes, and cultural tourism resources along the route are organically connected to build “fast-in, slow-out” cultural tourism routes, enabling tourists to gain a deeper understanding of the cultural characteristics of each region [3].

2.2. Quality improvement and upgrading of road and bridge landscape design

Road and bridge landscape: It refers to a landscape system with aesthetic, humanistic, and functional qualities, constructed on the basis of transportation infrastructure such as highways and bridges and their ancillary facilities. The landscape may include multiple design modes such as color, greenery, cultural symbols, and IP integration, serving multiple purposes including cultural promotion, ecological restoration, road empowerment, and roadside area development. The quality improvement and upgrading of road and bridge landscape design in the context of cultural tourism, on the other hand, refers to the systematic optimization of cultural expression, functional expansion, and value transformation on the basis of the original landscape design [4].

3. Integrated design system for road and bridge landscape in the context of cultural tourism integration

This paper takes the landscape design of mountainous expressway bridges and roads as its research subject and analyzes the composition of the design system from three aspects: coordinated landscape planning, four-dimensional upgrading, and supporting facilities. Typical mountainous expressways generally feature relatively large terrain elevation differences, high bridgetotunnel ratios, pronounced variations in sight distance, and strong ecological sensitivity. Accordingly, the overall highway landscape design should take full account of mountainous characteristics. On the premise of ensuring driving safety and maintaining ecological integrity, a roadandbridge landscape system should be created that is themed around local mountainandwater culture and regional folk culture, while highlighting distinctive local features.

3.1. Integrated coordinated planning of cultural tourism and roadbridge landscape

Landscape design for roadbridge projects under cultural tourism integration requires joint efforts from transportation, cultural tourism, environmental protection, and other departments to establish an integrated coordination mechanism, thereby ensuring the compatibility, systematicity, and culturaltourism attributes of the design. At the initial stage of landscape design for mountainous expressways, a systematic framework for the entire route should be established, emphasizing both the ecological baseline of the roadway and the regional cultural context as dual foundations. This framework coordinates landscape schemes for roadside spaces, key nodes, and supporting facilities, reducing the disruption of fragmented design to the overall visual coherence [5]. At the same time, integrating the landscape with the surrounding environment preserves natural characteristics to the greatest extent, making the highway landscape design more compatible and unified with its setting, and effectively avoiding visual incongruity.

At the level of visual identity, the landscape design consistently incorporates imagery of mountain and water features along the route as well as local cultural logos, enabling travelers to deepen their cultural awareness while driving. Moreover, the repeated placement of unified thematic cultural logos along the route facilitates the embedding of local cultural tourism IP. In addition, all elements of the highway landscape—including bridges, tunnels, and service area sculptures- are guided by a consistent design philosophy. These elements are divided into different modules and themes according to the route alignment, forming a sequential and coherent cultural tourism promotional narrative, while avoiding an excessive accumulation of disordered cultural symbols that could cause visual distraction to drivers.

3.2. Fourdimensional upgrading of landscape, culture, ecology, and function

Building upon the integrated, coordinated design of cultural tourism and roadbridge landscape, further systematic design measures should be refined and optimized from four dimensions: landscape, culture, ecology, and function. First, at the landscape design level, a systematic scheme is applied across the entire mountainous expressway to effectively link landscapes in different areas, while thematic color schemes are used for segmentation to enhance the visual order. For example, major bridges along the route adopt a unified coating method, while tunnel portals and interior wall coatings incorporate differentiated colors to create a wellarranged visual rhythm [6]. Additionally, road surface markings, guardrails, median strips, and other ancillary facilities are matched to the local terrain and scenic characteristics along the route, forming visual lines that interact with the native natural and ecological environment, thus enriching the landscape layers across different areas and comprehensively enhancing landscape resources in a multilevel and allround manner. Second, in terms of cultural design, a large number of cultural IP elements are integrated. Local mountainandwater culture and folk culture are abstracted into visual cultural symbols and incorporated into bridge reliefs, service area installations, and other design features, thereby constructing a cultural corridor along the roadbridge landscape. Third, ecological landscape construction is primarily manifested in the creation of green vegetation. Plants along both sides of the mountainous expressway are centered on native, adaptable species to build a threedimensional green space, while vegetation planting also serves to stabilize soil and protect slopes. Finally, in functional design, the scope is expanded from the single function of roadbridge transportation to include cultural tourism promotion and service provision. Comprehensive functions such as route mapping, cultural display, viewing services, and convenience services along the entire route are provided to offer travelers a more comfortable travel experience [7].

3.3. Comprehensive supporting measures in detail facilities, nightscape, and operation and maintenance

During the landscape upgrading and renovation process across the four dimensions of landscape, culture, ecology, and function, mountainous expressways should establish a complete supporting management system from three perspectives: detailed facilities, nightscape, and operation and maintenance. First, at the level of detailed settings, the entire route adopts crash barriers with a unified theme and structure, while incorporating local cultural IP decorative signage according to different sections, thereby creating visual unity in the roadbridge landscape. Simultaneously, ancillary facilities such as street lamps, trash bins, and signboards along the route are all designed with coordinated coatings to maintain consistency with the road landscape theme. Through such detailed depiction of landscape features, the cultural tourism characteristics of each locality are highlighted [8]. Second, in nightscape supporting design, the focus is on core areas such as tunnel portals, valleyspanning bridges, and interchanges. Combining the cultural tourism attributes of the localities to which each architectural node belongs, themed cultural lightscape designs are created—for instance, using lighting to outline the contours of landscape logos, scenic area introduction billboards, and other elements, thereby enhancing the visibility of cultural tourism landscapes without compromising driving safety. Finally, in terms of operation and maintenance support, mountainous expressways establish a longterm landscape design and maintenance mechanism, with regular monitoring systems for landscape facilities such as vegetation, coatings, and lighting, to ensure the effective implementation of landscape quality improvement efforts.

4. Design pathways for quality improvement and upgrading of roadbridge landscape in the context of cultural tourism integration

4.1. Cultural enhancement: Empowering with regional cultural context to create distinctive cultural tourism identities

Cultural enhancement lies at the core of roadbridge landscape design optimization. Accordingly, designers should tailor landscape themes based on the regional culture where the roadbridge is located, so as to elevate the recognizability and influence of local culture. For mountainous expressways, design can be segmented according to the cultural endowments of different sections. For instance, sections adjacent to mountainandwater resources may take the local mountainandwater culture as the design focus, creating landscape logos abstracted from mountains and waters, supplemented by distinct thematic colors and patterns, thereby forming a threedimensional promotional landscape system that highlights regional cultural IP characteristics [9]. Sections near folkcultural villages may rely on local folk culture to construct cultural themes, integrating natural scenery, intangible cultural heritage techniques, and other cultural features, and deeply merging vegetation, crash barriers, landscape installations, noise barriers, and other facilities with the ecological environment and local culture, allowing travelers to immersively perceive the customs and cultural connotations of different localities during their journey. In addition, dedicated cultural exhibition platforms should be designated within expressway service areas, leveraging smart devices, cultural tourism maps, and other media to provide travelers with more advanced and convenient cultural tourism promotional services, thereby channeling visitor flows to local cultural tourism development.

4.2. Ecological enhancement: Reducing development impact and constructing green ecological corridors

Roadbridge landscape design must give due consideration to ecological protection, while simultaneously empowering the cultural tourism experience through ecological landscapes, ensuring that construction disturbs the original environment as little as possible. In the quality improvement and upgrading of mountainous expressway landscape design, designers consistently adhere to the principles of ecological priority and landscapetourism integration. First, in greening landscape design, existing vegetation is taken as the foundation, with the introduction of diverse native plant species to create layered and varied community landscapes, forming green cultural tourism corridors that possess both ecological functions and aesthetic value. At the same time, the central medians of some sections are designed with shrubs, which serve to reduce glare and help conserve soil and water. Moreover, greening landscape designs at ramps, tunnel portals, and other locations adopt a gradient-matching pattern, which helps mitigate visual impact on drivers and alleviate visual fatigue. Second, the landscape design of underbridge spaces breaks away from traditional hardsurface approaches; designers combine the terrain and environment beneath bridges to create landscape walkways and microresting installations, incorporating local cultural paintings, reliefs, and sculptures. Existing vegetation is preserved to the greatest extent possible, while the scope of hardened surfaces is reduced, thereby achieving the dual goals of landscape beautification and ecological restoration.

4.3. Functional enhancement: Adapting to cultural tourism needs and establishing multifunctional spaces

On the basis of ensuring aesthetics, ecological soundness, and humanistic appeal, roadbridge landscape design must also take into account functionality, realizing the dual value of cultural empowerment for tourism development and economic empowerment for interchangeadjacent areas. In view of the current issue of unitary service functions of roadbridge facilities and their associated supporting infrastructure, designers incorporate a substantial amount of culturally relevant content into the landscape, thereby deeply integrating transportation, commerce, and cultural tourism [10]. First, designers establish diverse service zones in rest areas and parking areas, including cultural and creative products, local specialty agricultural products, cultural tourism maps, and smart services. While resting and refueling, travelers can learn about local cultural tourism through these service zones and purchase local specialties, thereby strengthening the promotion of regional cultural tourism. Second, the design incorporates comprehensive retrofitting of crash barriers, noise barriers, and other facilities along the entire route through painting and spraying, deeply and dynamically coupling the road landscape with local cultural tourism IP. These facilities thus not only ensure traffic safety but also achieve cultural tourism trafficgenerating effects. Third, the design makes full use of interchanges to create interchangeadjacent economic carriers, linking surrounding scenic areas and villagetown resources, and setting up cultural tourism display windows—for example, creating landscape phototaking spots that facilitate travelers' offramp visits and consumption, thereby attracting traveler attention to local cultural tourism and driving roadcorridor economic development.

4.4. Nightscape enhancement: Empowering with light and shadow art to activate nighttime cultural tourism scenes

Traditional roadbridge landscape designers have primarily focused on daytime landscape effects, lacking awareness of nightscape design, which has resulted in a scarcity of nighttime landscapes and a waste of

cultural tourism landscape promotional resources. In the landscape design of mountainous expressways, lighting design techniques are adopted to create a combined daynight landscape system, thereby offering travelers a richer landscape experience. Nightscape design fully takes into account driving safety, and therefore does not involve fullroute lighting; instead, key nodes such as valleyspanning bridges, tunnels, service areas, and interchanges are selected as nightscape design focal points. For example, tunnels in sections adjacent to mountainandwater resources take mountainandwater themes as the core, using gradual soft lighting at tunnel portals as a transition, while the tunnel walls are decorated with a combination of lighting and painting to create themed nightscapes. Moreover, lighting designs in different sections are coordinated with the lighting of surrounding towns and scenic areas, forming a tourism display axis that enhances travelers' cultural tourism experience.

4.5. Operation and maintenance enhancement: Establishing longterm mechanisms to safeguard landscape cultural tourism value

Integrated development of road landscape design, implementation, and maintenance is key to ensuring the longterm effectiveness of functions such as cultural tourism dissemination and traffic safety. Therefore, in the landscape design of mountainous expressways, a systematic longterm development mechanism should be constructed from the perspective of longterm road landscape operation. First, a modulebased management approach should be adopted for landscapes of different natures and forms, ensuring the rationality of each landscape's maintenance. For instance, greening landscapes are maintained through quarterly plant care, with professional horticulturists regularly pruning, fertilizing, and managing the vegetation. Lighting, safety facilities, and the like are subject to routine monitoring and control mechanisms. Managers can use intelligent control systems to monitor equipment operation status in real time and promptly repair or update damaged equipment. Paintings, murals, colored pavements, and other features require regular repainting, with the cultural content of murals and paintings kept dynamically updated to maintain travelers' sense of freshness. In addition, the cultural tourism display areas in parking and service zones also require regular updates to avoid aesthetic fatigue. Finally, maintenance responsibilities should be rationally allocated. Maintenance of mountainous expressway landscape facilities is jointly undertaken by transportation authorities, operating entities, cultural tourism departments, and other relevant bodies, while maintenance tasks for different road sections may be assigned to affiliated regional units, thereby forming a collaborative operation and maintenance management mechanism for roadbridge landscapes that ensures efficient and reliable landscape upkeep.

In summary, the core design contents, quantitative implementation parameters, and expected design objectives of the five enhancement dimensions can be summarized in **Table 1**.

Table 1. Design dimensions for quality improvement and upgrading of roadbridge landscape in the context of cultural tourism integration

Quality improvement dimension	Design content	Implementation parameters	Design objectives
Culture	Integrate IP, segmented narrative, cultural empowerment	IP implantation points ≥ 1000; service area exhibits ≥ 20 items	Create a distinctive cultural tourism identity
Ecology	Activate grey spaces, increase greening rate	Original plant retention rate ≥ 92%; slope greening 100%; underbridge space utilization ≥ 80%	Restore ecology and build a green cultural tourism corridor

Function	Service area upgrade, interchange empowerment, composite function expansion	Service area cultural coverage 100%; smart navigation coverage rate ≥ 80%; checkin point coverage ≥ 60%	Adapt to cultural tourism needs and drive road area development
Nightscape	Landscape lighting, expand publicity channels	Quantitative node coverage 100%; nightscape design along circulation routes ≥ 12 items	Create a daynight integrated landscape system
Operation and maintenance	Strengthen maintenance, achieve longterm development	Landscape maintenance coverage 100%; landscape life cycle ≥ 15 years	Ensure longterm exertion of landscape cultural tourism value

5. Conclusion

In summary, roadbridge landscape design under the integrated development of cultural tourism has broken away from the traditional, singular functional design philosophy. With the expressway network as the core carrier, a diversified and multidimensional design framework has been established from the perspectives of cultural tourism promotion, intelligent services, ecological restoration, and humanistic penetration. Meanwhile, designers have achieved cultural empowerment of the landscape through the integration of regional cultural IP pertaining to the roadbridge areas, unified thematic color schemes, overall routewide coordination, and segmented landscape characterization, thereby facilitating the systematic implementation of roadbridge landscape design across five dimensions—culture, ecology, function, nightscape, and operation and maintenance. This, in turn, creates a deepseated synergy between roadbridge landscapes, regional cultural tourism development, and roadarea economic stimulation. In the future, roadbridge landscape design can further adopt intelligent technological means to construct dynamic landscape models; such intelligent landscape systems would make it more convenient for travelers to learn about regional cultural tourism features, thereby enhancing the efficiency of cultural tourism dissemination.

Disclosure statement

The authors declare no conflict of interest.

References

[1] Guo T, Han S, Zhang D, et al., 2023, Optimization Strategies for Landscape of Spaces Under Elevated Roads and Bridges in Linyi City. Modern Horticulture, 46(1): 148–150.

[2] Liu W, Liang H, Wu M, 2025, Application of Sponge City Concept in Urban Landscape Design and Construction. Engineering Technology Research, 10(1): 5–7.

[3] Zhang F, 2024, Review of Landscape Renovation Schemes for Suzhou Creek Bridges at Wuning Road and Xikang Road. Shanghai Highways, 2024(1): 76–80.

[4] Zheng L, 2026, Practical Application of Landscape Design for Under-Bridge Spaces in the Context of Urban Renewal. Green Building, 18(1): 127–131.

[5] Sun X, Liu J, Feng M, 2026, Lightweight Design Strategy for Landscape Modeling of Pedestrian Overpasses. Municipal Engineering Technology, 44(5): 309–316.

[6] Liu Z, 2024, Embodiment of Human-Centred Concepts in Road and Bridge Design. Transportation Manager World, 2024(27): 52–54.

[7] Liu Y, 2025, Research on Landscape Planning and Design in Green Buildings. Foshan Ceramics, 35(7): 177–179.

[8] Gu X, Cui Z, Zhu J, et al., 2026, Experience and Implications of Highway Construction in Ice-and-Snow Tourism Regions—A Case Study of Yaxue Highway in Heilongjiang. Traffic Construction and Management, 2026(1): 200–202.

[9] Chen X, Dong L, Lü B, et al., 2025, Brief Analysis of the Application of Regional Culture in Municipal Road Landscape Design. Central Plains Culture and Tourism, 2025(8): 133–135.

[10] Zhang X, 2025, Exploration of Landscape Design Methods for Urban Interchange Highway Bridges. Product Design, 2025(5): 121–123.

Publisher's note

Bio-Byword Scientific Publishing remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.