Spatial Pattern Analysis in Landscape Planning for Scenic Road: A Multidimensional Service Oriented Approach

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ABSTRACT: With the concept of "The beautiful China" and the "People-oriented" deepen in China nowadays, the traditional method of road landscape planning and designing based on the major considerations of greening function and visual aesthetics was far from satisfying the demands of the times. The service quality that road providing was increasingly becoming the major concern in landscape planning. In this paper, in view of the four aspects of service function, service objects, service value and service quality, the concept of spatial pattern was introduced. And we proposed respectively the space pattern analysis method for scenic road service structure based on point axis system, the service functional division analysis method for scenic road based on diversified value, and the ecological service pattern analysis method for scenic road based on sustainable development. And the people-oriented comprehensive service system framework of scenic road landscape planning and the service-oriented landscape planning method system for scenic road were both established. Taking the Road S104 in GanSu province in China as the case study, the landscape comprehensive planning system for Road S104 was made on account of the multi-dimensional service function, to provide certain theory reference and method guidance for establishing the theory and technology system of scenic road landscape planning in China.

KEYWORDS

INTRODUCTION

In recent years, with the constant improvement of China's transportation network and rapid increase of family car ownership, self-drive journey has been from fashion into a common way of travel, and road corridor has become the carrier of another way of travel. With the deepening of the people-oriented concept, the traditional thinking of planning and design of road simply from greening function and aesthetic angle has been far not adapt to the request of the ages. Because of pedestrians as implementers of road function and the experience people of road environment, with higher requirements for a road as important public products, the planning and design process of scenic road need from a single traffic function to compound function of natural landscape, ecological environment, tourism, recreation and culture protection[1].
demand and landscape quality of road services are becoming increasingly important.

Scenic road is the road system developed from European and American countries in recent 20 years for the construction and protection of road ecology, resources and quality, and the continuation and development of the ecological environment and natural cultural heritage protection recent hundred years. It emphasized the coordinated development of its traffic function and the external environment resources and complied with the sustainable development of the internal and external integration of the transportation system so that to play an important role in promoting the protection of the ecological environment and resources in the modern transportation system[2-4].

Since scenic road could meet people's growing outdoor recreational demand, the most attractive scenic road resources integrated, withfully expand its landscape ornamental function, can provide the public with pleasant driving travel experience, which meets a variety of recreation demand of the tourists on a trip better as important public service products[5-8].

With the rapid development of road construction in China in recent years, more and more places began to exploratively construct scenic road, tourist road, green road etc. However, due to the current domestic scenic road construction in the early stages of development and less related theory research and practice guidance, a unified planning theory and technical system has not yet been formed and there are a lot of problems. On the one hand, at present the landscape planning of scenic road often begin to consider landscape planning after the completion of design even construction of road main facilities instead of simultaneously progressing with road planning and design. On the other hand, because of the scenic road lacking integrity and identification and the new landscape elements lacking the necessary coordination with the old elements in the landscape planning, the original style and historical features lose and new creation cannot be harmonious and unified with surrounding environment, which makes people lost the sense of identity to the environment.

As the public service products reflecting the function and value of traffic, landscape, ecology, recreation and other composite, scenic road is part of the region tourism services and need to build the theoretical system. As the result, taken National Road 101 in GanSu province as an example, this paper with people-oriented as the basic orientation, in view of the service function, service groups, service value, service quality from four aspects, carry out service space analysis, service function partition analysis, comprehensive service system framework of scenic road, explore scenic road landscape planning method system service oriented, provide certain theory reference and guidance method for perfect China's scenic road landscape planning theory technology system.
METHODS

*Space analysis in service structure of scenic road based on point axis system*

Scenic road is a concept of corridor whose purpose is to fully excavate potential besides function of road traffic so as to make it to be a multi-function complex of transportation, recreation and landscape\(^\text{9-10}\). Its width is much larger than the road itself, also including the roadside, horizon, radiation and other functional partition. Meanwhile, from the perspective of dynamic development, scenic road also forms multi-level corridor space structure through forming a huge network structure on the longitudinal and the surrounding series. This point axis spatial structure with evolution step by step and rich space level become a material carrier of multiple functions such as traffic, landscape and recreation of scenic road. It makes the traffic not only from a single function of road to composite services such as traffic, ecology, recreation and protection function, but also from a single road to strip travel traffic system even the network tourism destination\(^\text{10-11}\).

As the main axis, scenic road gradually extended to a point-shaft-network system from point-axis system, first through the "point axis" elements from the basic main road and the horizon belt extended to the radiation zone, second through the trails system, a secondary road and other secondary axis associated with peripheral tourism or service area. There are tourism spatial structure elements of complete service system on the spatial structure, as shown in Fig. 1.

![Figure 1. Formation stage of scenic road space structure.](image)

*Service functional division analysis of scenic road based on the pluralistic value*

From the angle of macroscopic, the spatial structure of scenic road is supported on the point axis system. Meanwhile analyzed from a cross section, the system of the point axis structure performances as the unique service functional partition constituted with four belts. These four belts of the functional partitions are the basic components of scenic road, each of which has different properties, functions and features, as shown in Fig.1.
Figure 1. Scenic road hierarchical structure and function space.

Ecological service pattern study of scenic road based on the sustainable development

Based on the patch theory, scenic road is one corridor inside the scenic spot or around. Its attractions around are patch corridor based on, and the whole area is the matrix corridor and patchrelying on. The size, character and ecological structure of corridor and patch restrained and limited by the matrix. As time goes, nature's own initiative and self-organizing can make patches gradually return to the face of the original matrix after the completion of scenic road. But if artificial corridors and patches are too strong and the transformation of matrix is too large, it will disturb the surrounding ecosystem\cite{13-15}. As a result, they can't restore to their original state, but also result in a certain destruction inner structure and self-organization of matrix. To show how to balance the relationship between the artificial corridors, patches and matrix and to protect the expressway ecosystem from ecology is the key problem in scenic road landscape planning.

People-oriented comprehensive service system framework of scenic road

As the public service products in regional tourism system, the function of scenic road is becoming more and more diversified. On the basis of the traditional transportation, tourism and other functions, it should also fully embody the leisure, entertainment, science and other service functions\cite{7}. And considering the diversity of service object, in addition to vehicles, the demand of other service groups, such as cycling, walking recreation, children, the elderly, the disabled, and even pets, should also be considered to target for landscape planning. With people-oriented concept as purpose, the comprehensive service system framework of scenic road will be established, and comprehensive service quality of scenic road will be improved, as shown in Fig. 2.
RESULT AND DISCUSSION

Study area
We took Road S101 in Gansu province as an example, which was about 75 km long from the Lanzhou city to Xiaguanying. As part of the backbone system at Yuzhong county in Gansu province, it was not only the important path for transportation of fruits and vegetables from peripheral villages and towns to Lanzhou city, but also one of the main lines to Xinglong Mountain which was the national natural forest protection area nearest to Lanzhou city. Xinglong Mountain was located in the arid and semi-arid climate on the loess plateau area but with humid climate. As a result, it was the green lung of Lanzhou and the important tourism summer place at Lanzhou city in Gansu province. Therefore, this quality of project service directly affected the development of Xinglong Mountain tourism.

Division and outstretch development planning of landscape service function
On the basis of trunk line of vehicles, increasing continuous bicycle lanes and waterfront plank road for foot, through the “one line and two way” we could build traffic structure balance, area and internal accessibility and efficient green transportation system, in order to meet the needs of different travel group and maximize the service function of ecological recreation, as shown in Fig.3.

![Figure 2. The comprehensive service system framework of scenic road.](image)

![Figure 3. Transportation structure planning meeting the demands of different travel group.](image)
Landscape ecological service pattern planning

Along this project there are lots of landscape elements and a complete ecological system, through the road landscape design, forming a green base with full use of native species and completing the natural ecosystem restoration and cultivation of "two corridors and two patches", referring to "road traffic corridor, natural water corridor, Xinglong Mountain forest patch, rural land patch", playing ecological service function along the natural and semi-natural, constructing regional natural ecology base and being integrated into a scientific and efficient ecological network, as shown in Fig.4.

Comprehensive service system planning of scenic road

We multi-dimensionally develop the different service function conforms to leisure sightseeing road and improve the tourist road leisure value and service quality. In combination with regional characteristics and project requirements, landscape design, accord with the different function of leisure sightseeing road, makes its service for different groups, through adding bicycle green, rest stop along the scenic area, plateau summer vegetable products selling point, the children's amusement facilities, rest facilities for the disabled, popular science information board and so on, to multi-dimensional enhance different service function of the project, reflect the tourism road recreational, humanism, education, interest, artistry, etc.

CONCLUSIONS

This study regards scenic road as a part of the regional tourism system, and focuses on the service function, service groups, service value, service quality from four aspects, and establishes a service-oriented scenic road landscape planning method.

Scenic road service structure space analysis method based on point axis system, is forming step by step evolution rule of point-shaft-surface space structure, by
the "dot" elements on scenic road main shaft line through multiple ribbon of functional partition. The multi-level structure of corridor space as a composite material carrier of multiple functions such as traffic, landscape and recreation, makes scenic road road from a single traffic function to composite service functions such as traffic, ecology, recreation and protection.

Scenic road service function partition method based on complex value, is considering basic elements and the hierarchical structure of scenic road, to divide scenic road into roadway, roadside, horizon and radiation of four functional spaces, each of which has different characteristics and elements.

Scenic road ecological service pattern analysis method based on the sustainable development, leading corridor, patch and matrix theory of landscape ecology into scenic road landscape planning, is of great significance for the natural ecosystem restoration and cultivation with scenic road.

Establishing a people-oriented comprehensive service system framework of scenic road can improve the comprehensive service quality, The indicators of comprehensive service system include transportation services, recreational services, popular science service, sports services, cultural services, ecological services and economic services, reflecting the accessibility, educational, interesting, humanism, rationality, ecology, participation of scenic road.

This study case based on the analysis of spatial pattern, with service-oriented landscape planning method of scenic road, carries out the landscape structure, space sequence planning, partition and developing planning of landscape service function and landscape ecological landscape service planning, embodying the comprehensive efficacy of "natural environmental protection, cultural landscape coordination, tourism resources development, agricultural economy pull", to construct comprehensive landscape planning system for S104 national road based on multi-dimensional service functions. Promoting location advantage through the optimization of landscape, this study case becomes an important window highlighting natural tourism resources and the plateau summer vegetable farming features in Lanzhou and bring more good investment efficiency to YuZhong and Lanzhou city the project locate in, which is also the demonstration project of tourism road in Gansu province even across the country.

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