Application of Satellite Remote Sensing Technology on Electrified Railway Network Greening Engineering

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Abstract. As the awareness of development of ecological civilization continues to strengthened, public expectations for landscape greening along the railway have gradually increased. The railway landscape greening has multiple functions of safety, environmental protection and aesthetics. Therefore, it is necessary to effectively combine the characteristics of the local area's natural ecology, custom and culture. To reflect the corresponding key points in the landscape greening design process, and apply the scientific greening concept to the engineering design.

1. Introduction
Since the 18th CPC National Congress, China has incorporated the construction of ecological civilization into the overall layout of the "five in one" of socialism with Chinese characteristics, and has unswervingly promoted the development of green ecology. The construction of ecological civilization has been raised to a new stage of the development of human civilization. The public's sensitivity to the ecological environment has greatly increased, and the expectations for the greening of railway engineering landscape protection and improvement of the environment are also increasing. The work of landscape greening has received unprecedented attention. According to statistics, as of the end of 2019, 51,252 kilometers of green lines of the 59,619 kilometers of national railway lines have been greened, a year-on-year increase of 5%, and the greening rate of railway lines reached 86%.

With the continuous deepening of ecological and landscape studies in my country in recent years, the application of railway landscape greening has more theoretical support and standardized standards.

2. The Function of Railway Landscape Greening
As a modern transportation facility, railway has the characteristics of "fast, comfortable, safe, efficient, and low-consumption", and plays an important role in promoting regional economic development
along the line. Its landscape greening plays an important role in improving the railway function as an auxiliary facility.

2.1. Safety Function
Railway landscape greening must be based on the safety of railway lines, and vegetation that can reinforce railway subgrades should be selected [1]. The roadbed slope green belt is closest to the traffic track. Studies have shown that fibrous root plants have a much better protection effect on roadbeds than large root plants, and even some large root plants will have a negative effect on the stability of roadbed slopes [2].

The safety function of landscape greening is also reflected in the soft isolation effect of dense green vegetation, which protects the safety of signals and power supply along the line [3].

In addition, greening design is done on both sides of the railway, and when the vegetation is full of changes and dotted with flowers, grass and shrubs, it will not only make the drivers and passengers feel comfortable mentally, relieve the fatigue of the journey, and be more conducive to driving safety.

2.2. Environmental Protection Function
Landscaping environmental features include two aspects, one is ecological functions, and another one is noise reduction.

The construction period and operation period will affect the natural landscape and ecological environment along the railway line. A good greening of the railway landscape can greatly improve the environment along the line and protect the original vegetation in the railway land and adjacent areas. At the same time, it can also help prevent soil erosion of road cuttings and embankments [4].

In addition, the railway landscape greening can improve the air quality along the line, reduce various pollutions caused by train noise, exhaust gas, and night operating lights in the environment along the line. At the same time, it also has a certain adsorption effect on dust, blowing sand, etc. [1].

2.3. Aesthetic Function
Landscape along the railway line has a strong appreciation of nature, which is the essence of the natural landscape railway landscape lies. In the design of landscape greening along the route, attention should be paid to the experience of passengers. The protective green belts on both sides of the railway should not obstruct passengers’ sight, and guide passengers to place their vision in the open natural landscape in the distance. At the same time, in the low speed section, small trees or colorful leaf plants can be added to the landscape greening to facilitate passengers to appreciate the nearby scenery [5]. In short, railway landscape greening requires careful design and layout of specific scenes to fully show the beauty of nature.

3. Principles of Railway Landscape Greening Design

3.1. Functional Principle
When designing the railway landscape, fully consider the characteristics of railway transportation itself, except for satisfying the functionality of transportation, ensure the safety and patency of the railway, and at the same time improve the environmental landscape along the line, and provide a safety, comfort and diversified journey experience for the passengers.

3.2. Ecological Principle
Ecological protection is the priority in railway landscape design, based on landscape ecology. To make use of the original topography and landforms as much as possible in the construction of the project, adopt local native green plants, and maximize the protection of the original nature reserves, historical and cultural relics, natural landscape resources such as water bodies and vegetation along the line. The selection of green plants should be compatible with the local ecological environment and climatic
conditions, and the species structure is as rich as possible, which can effectively improve soil quality and promote nutrient circulation, and play a role in maintaining water and soil, reducing noise and dust.

3.3. Overall Coordination Principle
The landscape along the railway is rich and diverse, and the hierarchical structure is obviously different. From the countryside to downtown, the visually continuous human-made landscape and natural landscape are composed of plains, hills, fields, and urban buildings and other factors, which interact and restrict each other. It is a composite regional landscape and an organic whole. The landscape resources along the route are organically integrated with the railway itself, so that the shape and color of the railway, the vegetation, and the shape and color of the main structures are in harmony with the surrounding environment. Through the neutralization and coordination of all links, the railway landscape design finally realizes the coordinated development of human and nature.

3.4. Economic Practicality Principle
Due to the properties and functions of the railway, the railway landscape has characteristics of long distance, large scale, difficult maintenance, and high cost. Therefore, in the construction of railway landscape engineering, make the best use of the original natural landscape resources and the use of local raw materials as far as possible. In the selection of greening plants, try to choose the original local plants, and form a multi-level natural plant community landscape through scientific allocation, through which to enhance the stability of the ecosystem and the self-renewal ability of plants, and reduce the cost of later manual management. All relevant departments should also coordinate and cooperate to make full use of the landscape resources along the route to form a cost-effective, high-functional landscape greening plan.

3.5. Territoriality Principle
Railways are located between cities, ranging from tens of kilometers to hundreds of kilometers. The regional span is large and the regional characteristics are very obvious. Different regions have their own natural landscape features, and natural landscapes have their own different structures, patterns and ecological processes. Therefore, the landscape greening design along the railway should be planned in an overall manner, adapted to local conditions, and pay attention to local customs, historical and cultural characteristics, so that the railway landscape presents different characteristics in different regions, and fully demonstrates the local customs and regional characteristics.

4. Characteristics of Landscape Greening in Different Railway Sections

4.1. Henan Section in Beijing-Guangzhou High-speed Railway
In this section tunnel is an important part for high-speed railway. The Shiwu section of the Beijing-Guangzhou high-speed railway is a remote distance of 840.7km with a bridge-tunnel ratio of 81%. The construction of the tunnel will cut a large area of the mountain and destroy the vegetation on the slope. Therefore, it is necessary to carry out a green design at the entrance of the tunnel, focus on the native vegetation in the mountains, and use the planting of plants to promote the stability of the slope, to further mitigate the adverse effect on nature view by the construction of the tunnel.

4.2. Railway Section from Chengdu to Dujiangyan
According to the overall urban planning layout of Chengdu, Dujiangyan, and Qingchengshan, the Chengdu-Dujiangyan section of the railway divides the landscape into four major areas, combining landscape resources, vegetation status, customs and culture factors, so that green plants can highlight the characteristics of each area.

(1) Anjing Station to Honguang Station
This section focuses on the ancient culture of Chengdu. The old buildings on both sides are densely constructed, through which the railway passes the city. The landscape greening is mainly based on the
greening of the urban vegetation along the line to achieve the purpose of sound absorption and noise reduction and beautification of the environment.

(2) Hongguang Station to Pixianxi Station
This section is located in the new city section of Pixian County and is dominated by industries. Therefore, green vegetation should mainly be used for anti-pollution and anti-hazardous gas functions. To achieve the effect of purifying the atmosphere, adsorbing fine dust, and improving the microclimate.

(3) Pixianxi Station to Chongyi Station
This section is a typical rural scenery. Both sides of the railway are mainly farmland and vacant land with a beautiful natural scenery. This section of the natural landscape is rich, but the railway passes through in the form of subgrade, thus the surface of the subgrade suffers water and soil loss during the construction period. Therefore, this section of landscape greening is mainly based on the side slope greening of the roadbed to achieve the purpose of side slope greening protection, water and soil conservation, and roadbed stabilization.

(4) Chongyi Station to Qingchengshan Station
This section contains both city view and scenic spots, and it also has historical and cultural heritage-Dujiangyan and Qingcheng Mountain. Landscape greening focuses on respecting local cultural characteristics and highlighting tourism resources.

4.3. Railway Section from Lijiang to Shangri-La
According to the altitude, geological conditions, nature reserves, etc. of the section to which the line belongs, the Lixiang Railway landscape greening is divided into three design sections.

(1) Lijiang to Hutiaoxia Section
There are multiple nature reserves, lakes, shrubs and other complex ecosystems in this section. The vegetation is in good condition, so the original landscape should be maintained. In order not to affect the landscape continuity of the nature reserve, greening on both sides of the railway shields the railway to a certain extent, but instead of using conventional large trees, local herbs, small shrubs and small trees are planted in layers, and the canopy line is lower than the passenger’s apparent height to prevent obstructing the passenger's appreciation range.

(2) Hutiaoxia to Jisha Section
The vegetation in this section is sparse, the climate environment of the nature reserve is rich, and there is a complete alpine ecosystem. The landscape of this section is dominated by vegetation restoration. When crossing the valley of the Haba Snow Mountain Nature Conservation Area, the sparse native shrub plant community is used to coordinate with the environment of the dry and hot valley.

(3) Jisha to Shangri-La Section
This section is mostly located in Xiaozhongdian and Bazi of Shangri-La Plateau, with high altitude, slightly undulating terrain, rich vegetation, and belongs to the ecologically fragile plateau area. The landscape design of this section is mainly railway slopes and protective green belts. The subgrade part is covered by low vegetation communities, leaving sight lines on both sides of the railway to the height of the car windows to enjoy the natural landscape along the way.

5. Conclusion
Landscape greening along the railway, as an auxiliary project of the railway, is an indispensable part of showing local cultural and ecological characteristics, soil and water conservation, noise reduction and dust prevention. Reasonable landscape design can highlight and beautify the overall characteristics of the area along the line. With the continuous development of society, requirements for landscape design along the railway are also increasing. As the railway traverses different ecological environment sections, landscape greening should have different focuses. It is necessary to avoid the pursuit of "green quantity" or green area standards in traditional thinking, which will cause unnecessary waste of resources. Different principles should be combined in the design to show the
corresponding functions of the railway landscape greening, and the comprehensive and reasonable design should be carried out according to local conditions to present a harmonious and unified, natural green landscape.

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