Research on the practice of Green Highway in Hainan under the thought of Ecological Civilization

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Abstract

To promote the construction of ecological civilization in the new era, we must adhere to the harmonious coexistence of man and nature and the way of ecological priority and green development. To the best of our knowledge, it is rare that comprehensively summarize the practical experience of green highway in a certain region was attempted. Taking Hainan Province as an example, this study systematically analyzes the practical application of green highway under the background of ecological civilization thought. It is worth exploring the experience of green highway construction with Hainan characteristics in line with the economic and social development of Hainan, therefore, it can provide reference value for promoting the high-quality development of green highway and provide strong support for the construction of Hainan free trade port.

Keywords: Green Highway, The Thought of Ecological Civilization, The Construction of Ecological Civilization

1.0 INTRODUCTION

The construction of ecological civilization is a millennium plan related to the sustainable development of the Chinese nation. Since the 18th National Congress of the Communist Party of China, the Party Central Committee with Comrade Xi Jinping at its core has taken the construction of ecological civilization as an important part of promoting the overall layout of the “five in one” and coordinating the promotion of the “four comprehensive” strategic layout. It has launched a series of fundamental, innovative and long-term work to promote the historic, turning and overall changes in the protection of the ecological environment, forming Xi Jinping thought of ecological civilization. Xi Jinping thought of ecological civilization is an important part of Xi Jinping thought of socialism with Chinese characteristics in the new era. It is a significant theoretical achievement made by the Communist Party of China in understanding the laws of the development of human society and the development of socialism with Chinese characteristics. It aims to provide powerful ideological guidance, fundamental follow and practical motivation for achieve the harmonious development of man and nature,
building a beautiful China and even a beautiful world. Building ecological civilization, advancing green development, and realizing beautiful China are important parts of realizing the great rejuvenation of the Chinese nation.

To promote the construction of ecological civilization in the new era, we must adhere to the harmonious coexistence of man and nature, firmly establish and practice the concept of "green waters and green mountains are golden mountains and silver mountains", unswervingly implement the new development concept, and adhere to the way of ecological priority and green development.

At present, scholars at home and abroad have conducted in-depth research on the practical application of green highway construction concepts in terms of policy [1], design [2-7], construction [7-9], and maintenance [10]. However, most of them take expressway projects as examples. Some scholar’s analysis the concept of green highway based on the examples of national and provincial arterial road [11-12] and rural road [13-14]. They all apply a single engineering project, and fail to comprehensively summarize the practical experience of green highway in a certain region. Zhang and Huang sort out the application of green and low-carbon concepts in New Zealand's green highway in terms of laws and regulations, construction standards, planning and design, summarize its practical characteristics, and put forward the enlightenment for China's green highway construction [15]. From this perspective, this study will take Hainan Province as an example to systematically analyze the practical application of Hainan's green highway under the background of ecological civilization thoughts, and try to propose some green highway construction experience with Hainan characteristics.

In the remainder of this paper, Section 2.0 will describe the concept of Hainan's green highway. Then, the specific practices and results of Hainan's green highway construction will be given in Section 3.0. Section 4.0 will present the experience and enlightenment of Hainan's green highway. Finally, the concluding remarks will be given in Section 5.0.

2.0 EXPLORATION OF HAINAN'S GREEN HIGHWAY CONCEPT

Hainan is the only tropical province in China. Hainan's unique ecological environment is a precious treasure bestowed by nature. Through years of practice and exploration, Hainan's traffic construction has found a green highway development path with Hainan characteristics.

The first is to put forward the "five roads" construction concept of "ecological roads, landscape roads, tourist roads, traffic roads, and happiness roads". Combined with the characteristics of Hainan's ecological environment and the development needs of major industries, it guides the highway construction to achieve sustainable development in the whole process from design to
construction.

The second is "the cost obeys the ecology". For the highway passing through the ecological environment sensitive area, the engineering environmental protection measures shall be given priority, and the cost factor shall be put in the second place, so that the infrastructure construction conforms to the local natural environment, which is to protect rather than destroy.

The third is to strengthen overall planning and coordination. In order to use resources intensively and economically, Hainan green highway strictly abides by the red line of basic farmland and ecological protection, and integrates the highway route selection planning and land use planning into the land space planning.

3.0 SPECIFIC PRACTICES AND RESULTS OF HAINAN'S GREEN HIGHWAY CONSTRUCTION

During the "13th Five-Year Plan" period, Hainan's highway transportation infrastructure construction has achieved remarkable results. By the end of 2019, the total mileage of highways has reached 38107 km, an increase of 11247 km or 41.9% compared with the end of the "12th Five-Year Plan". The density of the road network has increased from 0.79km/km$^2$ at the end of the "12th Five-Year Plan" to 1.12km/km$^2$, reaching the medium level of development in China.

In order to implement the practice of green highway, the Ministry of Transport issued the "Guiding Opinions on the Implementation of Green Highway Construction". The transportation industry of Hainan also formulated specific guidance documents for green highway construction according to the actual situation. In the whole life cycle of highway decision-making, design, construction, operation and management, various green technologies and environmental protection measures have been comprehensively applied, which has played a better role in economic and environmental benefits and realized the sustainable development of green highway.

3.1 ADHERE TO ECOLOGICAL DESIGN

At the beginning of planning and design, the principles of environmental protection route selection and ecological route selection are strictly followed, and the environmental impact analysis and evaluation of the project are carried out. The route scheme shall not occupy farmland and avoid environmental protection area and ecological sensitive area as far as possible. Taking the Wanning-Yangpu Expressway as an example, it bypasses the core area of Lanyang Hot Spring National Forest Park from the perspective of ecological route selection, so
as to avoid damaging the natural original vegetation. The project is listed as the first batch of national green highway typical demonstration projects. The Wuzhishan-Baoting-Haitang Bay expressway, located in the central mountainous area of Hainan, has reduced the damage to the water source protection area, scenic area, nature reserve and sensitive area of soil and water conservation in the process of design and construction. The Qiongzhong-Ledong Expressway follows the principle of "cost obeys ecology". Bridges and tunnels are suitable for bridges and tunnels. It maintains the original appearance of the mountains and rivers along the line, winning the reputation of "the most beautiful expressway on the cloud".

3.2 STRENGTHEN ENGINEERING ENVIRONMENTAL PROTECTION
A good ecological environment is the biggest advantage of Hainan’s sustainable development, and environmental protection design is an important part of highway construction. The Boao channel project has implemented the most stringent ecological and environmental protection measures, and achieved the perfect integration of culture, landscape and transportation. It has won the praise from all over the world, and has become a beautiful business card for the Asian forum to show China's image. The Jinjiang-Dafeng section of the provincial highway Jinma Avenue is rebuilt by crushing the damaged old cement pavement and using this as a new base layer to realize the recycling of old road resources. There are a lot of high liquid limit soil along the Meilan-Yanfeng section of the Haikou Ring Expressway, which can't be directly used for filling. Through improvement, it is used to fill the lower embankment, so as to realize "zero abandonment", reduce the occupation of land resources, and achieve the goal of ecological environment protection.

3.3 STRENGTHENING ECOLOGICAL RESTORATION
Ecology is a unified natural system and an organic chain of interdependence and close connection. In the design of Hainan's island-circle tourist highway, ecological priority is emphasized to avoid the impact on ecological sensitive areas to the greatest extent. The relationship between tourist highway and ecological wetland, nature reserve, and water conservation area is well handled to build natural ecological space corridor. For example, recycling the rainwater resources and restoring the ecological environment by using "sponge city" and ecological purification pool to treat the runoff of bridge deck. In the ecological landscape, it not only protects the original ecological natural style, but also highlights the local cultural characteristics. Considering the requirements of soil and climate conditions in different areas, local plants should be preferred to maintain the diversity and natural attributes of ecological and landscape types. In the slope protection of mountainous highway, the green form of planting bag is used to enhance the adhesion of organic matter on the slope surface and achieve good ecological restoration effect.
3.4 PAY ATTENTION TO GREEN CONSTRUCTION
In the process of highway construction, the pollution and damage to the ecological environment during the construction organization stage are the most serious. Therefore, the construction organization stage is also an important control link of green highway construction. The construction process follows the principle of "maximum protection, minimum damage, and maximum recovery", which means that it can be avoided without occupation and maintained without damage.

In addition, by means of standardized construction, intelligent control and other means, green environmental protection technology is adopted to minimize the negative impact on the environment, while improving the construction quality, extending the service life, and ensuring the economic and environmental benefits.

3.5 STRENGTHEN OPERATION MANAGEMENT
Green highway requires maintaining "safe, efficient and sustainable development" in the process of operation and management. It eliminates hidden safety hazards and improves the capacity and quality by strengthening maintenance management. In the process of environmental quality monitoring, environmental protection project use effect inspection and ecological restoration investigation, problems are found and solved in time, so as to reduce the adverse impact and achieve harmony.

4.0 EXPERIENCE AND ENLIGHTENMENT OF HAINAN GERRN HIGHWAY
4.1 FIEMLY ESTABLISH THE CONCEPT OF "ECOLOGICAL PRIORITY AND GREEN DEVELOPMENT"
Good ecological environment is the strongest advantage and capital of Hainan's development. Hainan's transportation construction should firmly establish the development concept of "green water and green mountains are golden mountains and silver mountains", properly handle the relationship between development and protection, and strictly abide by the red line of basic farmland and ecological protection. Additionally, it is very significant to give full play to the role of backward force, guidance, optimization and promotion of ecological environment protection.

4.2 DEEPLY ENDERSTAND THE REQUIREMENT OF "BUILD ROADS IN, DON'T BRING DAMAGE IN"
Transportation infrastructure construction should conform to the natural environment, which is to protect the ecology rather than destroy the ecology. Green highway construction means to
thoroughly implement the development concept of innovation, coordination, greenness, openness and sharing throughout the life cycle of the highway, so as to save resources, protect environment and reduce pollution to the greatest extent. At the same time, the construction of green highway should pay attention to the improvement of use functions and service quality for providing people with safe, comfortable, convenient, beautiful and harmonious highways with nature.

4.3 PRACTICALLY IMPLEMENT THE MEASURES OF "STRENGTHENING ECOLOGICAL AND ENVIRONMENTAL PROTECTION AND RESPECTING THE HARMONY OF NATURE"

Respecting nature, protecting nature, and restoring nature are important goals of Hainan’s green highway construction. The construction of Hainan's green highway should focus on the environmental coordination. In the process of highway design and construction, the sensitive ecological environment should be designed to prevent unnecessary impact of highway construction on the original ecosystem. For the sake of achieving maximum protection, minimum impact, and strongest natural restoration, ordinary highways are constructed into green highways with resource saving, eco-friendly, energy efficient.

5.0 CONCLUSION

To protect the ecological environment is to protect the productive forces, and to improve the ecological environment is to develop the productive forces. The Party Central Committee has given Hainan the strategic orientation of "three areas and one center", and the construction of Hainan free trade port has started smoothly. In the development process of Hainan, the construction of transportation infrastructure is playing a fundamental and leading role. We should thoroughly study and understand Xi Jinping’s thoughts on ecological civilization implement the new development concept, make highway construction and transportation pay more attention to ecological civilization, achieve high-quality development, and provide strong support for the construction of Hainan free trade port.

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