

Thoughts on Green Highway Construction in Qinghai-Tibet Plateau

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Abstract. On the basis of combining the unique characteristics of the natural environment and the fragile and sensitive ecological environment in the high-cold and high-altitude areas, the difficulties and challenges in the construction of green roads in the Qinghai-Tibet Plateau are analyzed, and the construction of green roads in the Qinghai-Tibet Plateau should have its own unique characteristics. Relevant technologies and eco-environmental protection measures for green road construction in high-cold and high-altitude areas, and specific suggestions for green road construction on the Qinghai-Tibet Plateau, aim to provide certain ideas for the construction of green roads on the Qinghai-Tibet Plateau for reference.

1 Foreword

The Qinghai-Tibet Plateau is a special area with rich natural resources but fragile ecological environment and underdeveloped economy^[1]. It belongs to a typical area of high cold and high altitude, with harsh natural environment and sparse population. Highway is the most important mode of transportation on the Qinghai-Tibet Plateau. There are still problems such as insufficient total volume, low technical level, low road network density, and weak disaster resistance. Highway construction in the Qinghai-Tibet Plateau is still in large-scale development for a long time to come. stage. In the process of highway construction, while pursuing efficiency, quality, and engineering durability, the issue of environmental protection has risen to a very important level. The 18th National Congress of the Communist Party of China has made a comprehensive deployment for the promotion of the “five in one” overall layout in the new era. China has vigorously established and practiced the concept that green water and green mountains are golden mountains and silver mountains, treating the ecological environment like life, and implementing the “four The Ministry of Transport issued the “Guiding Opinions on the Implementation of Green Highway Construction” (2016.07) to promote the construction of green highways, so as to achieve a new leap in the sustainable and scientific development of highway construction. In plateau ecologically fragile areas, it is particularly important to accelerate the construction of green roads. At the Seventh Central Tibet Work Forum in August 2020, General Secretary Xi Jinping proposed that protecting the ecology of the Qinghai-Tibet Plateau is the greatest contribution to the survival and development of the Chinese nation. It is necessary to firmly establish the concept that green waters and green mountains are golden mountains and silver

mountains and protect them. The life and trees of the plateau, thousands of rivers and mountains, make the Qinghai-Tibet Plateau a highland of national and international ecological civilization. Speeding up the construction of green roads is a manifestation of the implementation of “protecting the ecology of the Qinghai-Tibet Plateau, protecting the high-virgin spiritual plants and mountains”.

2 The current characteristics of the ecological environment in the Qinghai-Tibet Plateau

2.1 The Qinghai-Tibet Plateau has unique natural environmental characteristics and important ecological functions

Located in the central part of the Asian continent, the Qinghai-Tibet Plateau is known as the “third pole of the earth”. It has the characteristics of frequent geological activities, strong solar radiation, fragile ecology, low temperature, and large temperature differences. It is called the northern hemisphere climate change adjustment zone, and is our country Even the important ecological function areas in Asia are also important ecological security barriers. They are rich in natural resources. Many types of ecosystems such as forests, grasslands, wetlands, and farmlands contain abundant biological species. Therefore, the Qinghai-Tibet Plateau is also home to rare wild animals. Natural habitats and plateau species gene banks are one of the key areas for the construction of ecological civilization in China, and they have great ecological value [1~3] and a special strategic position.

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2.2 The ecological environment of the Qinghai-Tibet Plateau is fragile and sensitive, and the self-regulation ability of the ecosystem is weak

The Qinghai-Tibet Plateau has frequent geological activities, a complex climate and a very fragile ecological environment. In the Qinghai-Tibet Plateau, the area of moderately and severely vulnerable areas accounted for 74.79% of the total area, and the slightly and slightly vulnerable areas are only distributed in a few areas [1,4]. The Qinghai-Tibet Plateau is a typical high-cold and high-altitude area. Its ecosystem is fragile and unique. The terrain is relatively high. The characteristics of cold climate make it difficult for vegetation to grow in most areas, and the carrying capacity of resources and environment is extremely limited. During the construction of highway construction projects, construction activities such as soil borrowing, spoiling, and roadbed construction will inevitably destroy the original landform and surface vegetation. Therefore, in plateau areas with fragile ecological environment and weak ecosystem self-regulation The concept of green recycling and low carbon is of great significance to the development of green road construction.

3 Difficulties and challenges of green road construction on the Qinghai-Tibet Plateau

3.1 The harsh alpine climate leads to poor operation of the road supporting environmental protection facilities

The construction of green roads in the Qinghai-Tibet Plateau needs to face many difficulties and challenges under the conditions of high cold and high altitude [5]. The Qinghai-Tibet Plateau, known as the snow-covered plateau, has the characteristics of an alpine climate, with low temperatures and large temperature differences, resulting in poor operation of some road supporting environmental protection facilities. For example, the Qinghai-Tibet Plateau highway service area is equipped with integrated sewage treatment facilities. Due to the high altitude and low temperature, the operation effect is often poor, especially in winter, it may even fail to operate normally, resulting in waste of environmental protection facilities and waste of sewage. Disposal.

3.2 The terrain is complex, the terrain is steep and changeable, and it is difficult to implement environmental protection measures for highway construction

The Qinghai-Tibet Plateau is known as the "Roof of the World". Its vast area, complex and diverse terrain, and steep and volatile terrain not only pose challenges to road construction itself, but also cause certain difficulties in the implementation of certain environmental protection measures during the construction process. For example, the Qinghai-Tibet Plateau is well-developed water system

and is the source area of many major rivers in Asia. It has the characteristics of sensitive water environment and high water body protection. In the process of highway construction, a large amount of mud is often generated due to the construction of bridge cast-in-place piles, which has good stability characteristics. , Can be placed in the nature for a long time without being decomposed. If the waste mud is not treated in time, it will have a great impact on the environment. Generally, the traditional mud treatment method is mainly to set up a sedimentation tank on the construction site. After the mud is naturally precipitated, the precipitated mud is transported to the garbage dump to be naturally dried by tank trucks. On the Qinghai-Tibet Plateau, the mud is installed unconditionally near the bridge due to topography. Sedimentation tanks and garbage dumps are far away from the construction site and the transportation cost and time cost are relatively high. Therefore, it is difficult to implement mud water treatment measures during the construction of the Qinghai-Tibet Plateau highway. The mud water overflow phenomenon often occurs.

3.3 Environmentally sensitive areas are widely distributed, ecological protection requirements are high, and ecological restoration is difficult

The unique natural environment of the Qinghai-Tibet Plateau has created a rich ecosystem. According to statistics, the area of protected wetlands, natural forests, grasslands, meadows and deserts on the Qinghai-Tibet Plateau account for 44.62% of the total area of the plateau's similar ecosystems. , 10.03%, 53.17%, 34.58% and 23.68% have played an important role in improving the ecological conditions of the Qinghai-Tibet Plateau and maintaining land ecological security. It is precisely because the Qinghai-Tibet Plateau has such diverse ecosystems and important ecological values. In order to protect the Qinghai-Tibet Plateau ecology and maintain biodiversity, the Qinghai-Tibet Plateau region plans to establish a large number of environmentally sensitive areas such as nature reserves. According to the White Paper "The Status of Ecological Civilization Construction on the Qinghai-Tibet Plateau" published by the State Council Information Office on July 18, 2018, the Qinghai-Tibet Plateau has established 155 nature reserves of various types, covering an area of 822,400 square kilometers, accounting for approximately 31.63% of the total area of the plateau. , Accounting for 57.56% of the total area of China's terrestrial nature reserves, basically covering the plateau's unique and fragile ecosystems and rare species resources.

Nature reserves generally have well-preserved ecosystems in their natural state, and are often natural concentrated distribution areas of rare and endangered wild animal and plant species, with rich biological species resources and greater ecological value. However, because of this, the requirements for ecological protection are also high, and "traceless" construction is generally required in nature reserves. In addition to the main highway construction process, the establishment of temporary construction sites such as soil removal yard and material

yard will also cause certain damage to the ecological environment of the plateau. Due to the limitation of the climate conditions of the Qinghai-Tibet Plateau, the growth of vegetation is difficult and the vegetation restoration cycle is relatively long. Therefore, once the plateau ecological vegetation is destroyed, it is more difficult to restore and improve the ecology. Therefore, after the completion of road construction on the Qinghai-Tibet Plateau, it is more difficult for the ecological restoration of temporary land occupation such as soil taking and spoil yard and material yard.

4 Several suggestions for green road construction on the Qinghai-Tibet Plateau

Based on the natural characteristics of the Qinghai-Tibet Plateau of high cold, drought, and hypoxia and the fragile and sensitive ecological environment, the difficulties and challenges faced by the construction of green roads in the Qinghai-Tibet Plateau are far greater than those in other regions. Therefore, the construction of green roads in the Qinghai-Tibet Plateau should have its own unique application. Regarding the relevant technologies and ecological environmental protection measures for green road construction in high-cold and high-altitude areas, this article focuses on the unique environmental characteristics of the Qinghai-Tibet Plateau, combined with the problems existing in road construction and operation, and puts forward the following suggestions to provide some suggestions for the construction of green roads on the Qinghai-Tibet Plateau. The idea is to lay the foundation for the comprehensive construction of a green circular low-carbon transportation system and the protection of the ecological environment of the Qinghai-Tibet Plateau^[5].

- Strengthen the anti-freezing and heat preservation measures of the sewage treatment system of highway service facilities, and use sewage treatment technology suitable for high-cold conditions. In the Qinghai-Tibet Plateau, affected by the high-cold natural conditions, general integrated service facilities and small-scale sewage treatment facilities cannot achieve good operating results. The anti-freezing and thermal insulation measures of the sewage treatment system should be strengthened to ensure its normal operation, and the operation can be adapted to cold areas. Conditional CWSBR process, the unique flexibility of the process, the change of the operating cycle and the adjustment of the control package, the process can make the process in the cold area outdoor minimum temperature $-20^{\circ}\text{C} \sim -40^{\circ}\text{C}$, and still achieve satisfactory operating results^[6].

- Optimize the mud water treatment plan, and use integrated movable bored pile mud water treatment facilities. Limited by the topographical conditions of the Qinghai-Tibet Plateau and other factors, the economic and time costs of mud transportation are relatively high. With the help of certain Tibet highway environmental protection acceptance projects, it is found through investigation that most construction units generally use simple small sedimentation tanks for the treatment of

construction mud water. After simple sedimentation, the water body is directly discharged, and the sedimented mud is naturally evaporated and covered with soil for burying. However, usually the construction site has a limited sedimentation tank and the natural sedimentation process is slow. It is difficult to ensure that the construction slurry is processed in time. At the same time, because the water quality after natural sedimentation is relatively poor, direct discharge will affect the surface water quality and threaten the river water. The normal growth of organisms. Promote the construction of green highways on the Qinghai-Tibet Plateau. It is recommended to optimize the traditional mud water treatment methods based on the actual conditions of the Qinghai-Tibet Plateau, and use integrated movable mud water treatment facilities suitable for high-cold and high-altitude areas to solve the environmental pollution caused by the infused mud water during road construction. Problem, effectively reducing the impact of highway construction on the water environment.

- Recycling and comprehensive utilization of road construction waste residues, reducing temporary land occupation settings, and reducing its damage to the ecological environment. The terrain of the Qinghai-Tibet Plateau is complex, and the construction of highways crossing mountainous sections will inevitably involve large-scale excavation or tunneling. No matter which scheme construction, a large amount of waste residue will be generated. If it is directly abandoned, a special waste residue yard needs to be set up. A series of environmental problems such as destruction of surface vegetation and soil structure^[7]. At the same time, due to the harsh climatic conditions of the Qinghai-Tibet Plateau, it is difficult to restore vegetation in the later stage of the waste dump, which affects the landscape environment, and the waste is easily induced by instability. Secondary geological disasters. Therefore, it is recommended to use resource recycling as the concept, combined with the nature and characteristics of waste slag, and adopt roadbed backfilling, borrow pit and stock yard leveling and restoration methods for comprehensive utilization to reduce the damage to the ecological environment caused by temporary land occupation.

- Improve the construction of road carbon sinks with the concept of "carbon compensation". Highway construction is bound to permanently occupy some land and change the type of land use along the highway. Due to road construction, other types of land are turned into land for transportation, thereby reducing the vegetation coverage along the road. In order to reduce the impact of road construction on the ecological environment along the route, it is recommended to improve road carbon sinks through road greening and vegetation restoration, including: ① Using wetland construction technology to build road ecological side ditches. In interchange areas, service areas, toll stations and other areas, ecosystem compensation, road runoff purification, and landscape beautification are realized by creating functional wetlands^[8-9], combined with local vegetation characteristics, try to select local native greening species, and set up grass-planting side ditches. Do a good job of

tracking and maintenance to ensure that road runoff can be effectively treated. ②Construction of highway carbon compensation green area. Highways are areas with high carbon dioxide emissions. A large number of "carbon-compensated" green areas have been established in interchanges, service areas, toll stations, and along highways to improve the carbon sequestration capacity of roads and fundamentally reduce the impact of road construction on the plateau ecological environment. ③ Implement "traceless" construction measures outside the main highway project. Before using the temporary land occupied by highway construction, the turf or surface soil should be stripped according to the requirements of the highway environmental assessment, and measures such as thatch cover and watering should be adopted for regular maintenance. After the construction is completed, the temporary land occupied by the highway should be promptly restored and tracked., To achieve the "no trace" construction effect, and minimize the ecological environmental impact caused by highway construction.

5 Conclusion

The Qinghai-Tibet Plateau, as a typical area of high cold and high altitude, has the characteristics of low temperature, strong solar radiation, and fragile and sensitive ecological environment. It is a special area with unique natural environmental characteristics. The implementation of green road construction on the Qinghai-Tibet Plateau is a manifestation of the implementation of General Secretary Jin Ping's proposal of "protecting the Qinghai-Tibet Plateau ecology, protecting the high virgin spiritual vegetation, and thousands of mountains and rivers.

This article combines the characteristics of the ecological environment of the Qinghai-Tibet Plateau and the difficulties and challenges in the construction of green roads on the Qinghai-Tibet Plateau, and proposes targeted technical methods and ideas for building green roads in the special environment of high cold and high altitude, that is, the sewage treatment system of service facilities adopts antifreeze Insulation measures and the use of CWSBR sewage treatment technology adapted to high-cold conditions to solve the problem of poor operation of sewage treatment facilities in the Qinghai-Tibet Plateau; use of integrated movable mud water treatment facilities to solve the environmental pollution problem of infused mud water during road construction; cycle integration Use highway construction, especially a large amount of tunnel waste slag, to control the setting of waste slag yard from the source to reduce its damage to the ecological environment; with the concept of "carbon compensation", improve road carbon sink construction to alleviate the ecological environment generated by highway construction The impact is intended to provide a certain reference and reference for the construction of green highways on the Qinghai-Tibet Plateau.

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