Research on Application of Highway Green Construction Technology

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Abstract. Studing on Guangdong Renbo highway, the project design, process improvement and technology promotion of green construction were carried out for highway construction. By establishing a green environmental protection construction management system, promoting the application of green construction technology, vigorously implements the green building technology methods and management concepts throughout the line, and comprehensively enhances the technical level of energy saving and environmental protection of highway construction.

1. Introduction

In recent years, with rapid development of highway construction and the emergence of environmental problems, China is gradually studying the establishment of various highway environmental management technical regulations and standards to control or avoid the negative impact of highway construction on the environment. Green construction has become an important task in protecting the highway environment and reducing energy consumption[1-3]. In 2016, the Ministry of Transport issued the “Guidelines for the Implementation of Green Highway Construction”, which requires the active application of energy-saving technologies, strict construction environmental protection, and the purpose of reducing energy consumption and protecting the ecological environment through series of measures and standardized standards.

Green environmental protection construction is a standardized, low-carbon, low-energy-consumption, environmentally-friendly and efficient construction scheme, process, or technical method[4] which can reduce carbon emissions, reduce energy consumption, and strengthen environmental protection[5][6]. It can also enhance economic efficiency. It is an important embodiment of our country's development of green highways and the implementation of a powerful highway.

This project relies on the projects of Renhua to Boluo highway (Referred to as Renbo Highway) in Guangdong Province. It has carried out plans for the construction of a green environment protection project for road construction, upgrading of technology, and promotion of technology within the scope of the entire line. Vigorously implement green construction technology methods and management concepts, and comprehensively upgrade the technical level of energy conservation and environmental protection for highway construction.

2. Relying on the project

Guangdong Renbo Highway is the second longitudinal section of the national highway network “Wuhan-Shenzhen Highway” and is also the fourth vertical section of “Guangdong Provincal Highway Network Planning”. The project is located in the mountainous area in the northeast of Shaoguan City,
north of Guangdong Province. The route starts from Chengkou Town in Renhua County, along the lines Renhua, Sixing, Wengyuan and Xinfeng. It connects to the Daguan Highway at Lianping. The route is 167.043km long. The construction of the project is of great significance for giving full play to the overall benefits of the road network and increasing the rapid passage of the province in north Guangdong.

3. Construction of green and environmental protection construction management system during highway construction

3.1. Standardized Management
Project a research and formulation of a strict green environmental protection construction management system will be conducted from the beginning of the construction preparation period. The energy conservation and environmental protection requirements for the construction of the project will be included in the tender during the project bidding and tendering. Detailed environmental protection work flow, and display on the construction camp. According to the Green Construction Management Regulations, the Project Management Office requires: (1) The bidding documents clearly require that the construction and supervision units be equipped with 1~2 environmental engineers, and be responsible for environmental protection supervision and management during the construction process; (2) Established to manage The Director took the lead in environmental protection and water and soil conservation work leading groups to carry out guidance on the environmental assessment measures proposed by the environmental assessment program and the soil and water conservation plan; (3) requiring the construction and supervision units to set up a leading group for environmental protection and soil and water conservation work separately and formulate corresponding Environmental protection assurance measures.

3.2. Establishing evaluation mechanism
In order to give full play to the construction unit’s advantages in construction technology improvement, the project department has established a regular evaluation and appraisal system for green and environmental protection construction, rewards and rewards construction units that adopt new technologies and new technologies, and promotes and publicizes them to carry out projects across the entire line. Demonstration in order to achieve the effect of green energy conservation and emission reduction. During the construction period of the project, a total of 8 appraisals and evaluations were conducted, and 14 construction units that promoted advanced green environmental protection construction techniques and equipment during the construction process were commended and rewarded. This greatly encouraged the construction unit to carry out the enthusiasm for green environmental protection construction. It lays a solid foundation for improving the green environmental protection level for engineering construction.

4. Implementation of environmental protection technology

4.1. Pavement construction asphalt mixing plant LNG heating technology
The asphalt mixture of Renbo highway project is mixed by batch mixers, and at least 3 asphalt mixing stations are installed on the whole line. The original design uses heavy oil as heating energy. When the viscosity of the heavy oil is too large, the atomization is poor, the combustion is not sufficient, and the turbid black smoke appears. The residual carbon after combustion is more, and the asphalt concrete station using the heavy oil as a fuel has been facing severe air pollution problems. With the popularization of natural gas, especially the promotion and application of compressed natural gas (CNG) and liquefied natural gas (LNG), natural gas has become the cleanest and the right price fuel. The use of natural gas to supply asphalt mixture mixing station is not only effective, safe, easy to manage, but also less expensive than fuel. It is estimated that the entire line of construction LNG heating technology for asphalt mixing stations will replace fuel 147,571toc, save energy 307,129tce, and save costs 148 million yuan.
4.2. Mixing station resource recycling comprehensive utilization technology
The raw material partition wall of the mixing station, which is being promoted throughout the project, adopts a modular steel retaining wall instead of a traditional brick retaining wall, which can be reused, has higher safety, and achieves environmental protection and energy saving effects.

The raw material partition wall of the mixing station adopts a modular steel retaining wall, and the steel retaining wall can be reused, while the traditional concrete partition wall can not be reused. A mixing station calculated according to 10 raw material partitions can save about 26,250,000 yuan in cost and reduce 75m$^3$ of concrete waste residue.

After the completion of the concrete partition wall project, it must be destroyed, discarded, and the construction waste generated must be piled up and buried, which will cause environmental impact and waste resources. The steel plate partition walls only need to be made of concrete foundations, and all the walls are manually welded with steel plates and steel pipes. After use, the steel partition wall can be directly recycled and reused, without generating construction waste, without affecting the surrounding environment, energy saving and environmental protection, and in line with the concept of a green highway.

4.3. Seven-stage sedimentation tank waste water recycling technology
A seven-stage sedimentation tank is set in the water-washing area, and a three-stage sedimentation is set in the mixing area to collect and reuse the waste water, thereby realizing the recycling of water resources. Through the construction of a seven-stage sedimentation tank waste water recycling system at the mixing station site, waste water generated during raw material cleaning, vehicle cleaning, and construction of spray and clinker processing processes can be collected, recovered through sedimentation, and reused. According to statistics, a tendering station of the tendering project will produce 37m$^3$/day of recyclable waste water at full capacity, and will directly reduce mud pollution to the surrounding environment.
4.4. Tunnel liner lining curing and dust removal trolley technology

Smart spray maintenance system consists of supply pool, high lift pump, intelligent control equipment, water pipeline, spray pipe, drainage pipe and maintenance water collection and saving facilities. It can set spraying time and duration, and recycle water for conservation. To save resources, save labor, and achieve intelligent spray maintenance. Considering that multiple prefabricated beams are kept at the same time, in order to ensure the water pressure, each piece of prefabricated beams should be staggered in time, and at the same time, in order to ensure a uniform temperature, a long plastic sheet is placed on both sides of the prefabricated beam roof and drooped to the ground. The top plate is made of geotextiles. Cloth cover, water moisturizing, in order to form a greenhouse on both sides of the web, moisturizing insulation. Conservation time is not less than 7 days.

The tunnel lining curing dust-removing spray trolley can achieve uniform spray curing and obvious dust removal effect. The use of tunnel-lining curing and dust-removing spray trolleys can effectively save water resources and labor costs. According to the tunnel 100m conservation unit calculation, each equipment can save 3.5m$^3$ of water compared to the traditional conservation process. The use of this equipment can spray evenly, the quality of maintenance is significantly improved, the tunnel dust removal is obvious, the resources are effectively saved, and the environment is protected.

5. Conclusion

Through the establishment of a sound green environmental protection construction management system, vigorously promote low-carbon and energy-saving environmental protection construction technologies and processes, and promote energy-saving environmental protection equipment, can effectively play the initiative of construction managers and construction staff, the construction of highway projects, the level of green environmental protection Raise to a higher level and ultimately achieve a coordinated development of road construction and environment.

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