

The Natural Environment Protection Technology of Expressway

Konstantina Fotia*

National Yunlin University of Science and Technology, Douliu 640, Taiwan

**corresponding author*

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Abstract: With the rapid development of highway construction, various environmental problems have become increasingly prominent, especially the protection of natural environment has attracted more and more attention from countries and governments. This paper mainly expounds the technology and methods of highway natural protection. First, it introduces the research background, significance and related concepts at home and abroad. Secondly, it analyzes and summarizes the existing road planning in China and puts forward the shortcomings. At the same time, it also studies the highway natural environment protection technology and conducts performance tests. The test results show that the natural protection technology can accurately monitor the highway conditions, and then calculate the comprehensive benefit index of ecological engineering based on the data obtained. Therefore, the economic and social impact of the expressway project will be evaluated. Finally, from the aspects of improving the traffic system and road traffic management, we propose corresponding measures and suggestions to improve the specific situation of the current situation. We should strengthen environmental protection publicity, improve people's awareness of the importance of environmental protection, and improve public participation and enthusiasm.

1. Introduction

With the progress of society, more and more expressways have been built, and people have gradually attached importance to road traffic safety. When driving on the expressway, there are often many human factors that cause traffic accidents [1, 2]. Therefore, how to improve the safety and traffic capacity of traffic roads is one of the most important topics in highway management at this stage, while natural environment protection technology can reduce a series of economic losses such as casualties and property losses caused by accidents caused by environmental pollution, as

well as economic benefits within the scope of impact. Therefore, we need to study problems from reality and solve problems to meet the needs of highway development [3, 4].

Many scholars have conducted relevant research on the natural environment protection of expressway. The research of foreign scholars on natural environment protection technology mainly focuses on the following two aspects: first, environmental monitoring methods and means. Foreign experts have conducted a lot of research on expressway traffic system and put forward a series of theories; The second is to explore the problems of ecological environment protection in the process of highway construction from the natural geographical conditions, climate characteristics, hydrology and other factors [5, 6]. Domestic researchers are involved in road engineering pollution prevention technology. Some scholars pointed out through the analysis of the current situation and characteristics of urban road traffic in China that at this stage, artificial neural network prediction method and gray clustering algorithm are mainly used to build models for traffic congestion evaluation [7, 8]. Therefore, the above research has laid the foundation for this paper.

During the construction of expressway, natural environment protection is a very important work. It is not only related to the people's living standards and health and safety, but also affects the country's social and economic development. Therefore, we need to effectively manage highways to control the probability of traffic accidents and reduce environmental pollution. This paper analyzes the contradictions, mutual constraints, coordination and complexity between the natural ecological environment and road engineering, and puts forward corresponding solutions: adopt advanced scientific means to achieve highway greening construction, with the goal of improving ecological benefits, Strengthen the construction of expressway environmental protection monitoring system and strengthen environmental protection supervision.

2. Discussion on Natural Environment Protection Technology of Expressway

2.1. Development of Expressway Natural Environment Protection Technology

The natural environment protection of expressway is mainly people-oriented, focusing on the harmonious development between people and the environment [9, 10]. The natural environmental factors and social and economic benefits should be taken into account in highway construction. For natural protection, the most important thing is to ensure the coordination and unity of the relationship between people, roads and surrounding residents to achieve sustainable, stable and healthy development of the ecological environment. For ecological protection, the most important thing is to pay attention to the problem of water and soil loss, which can also be said to be one of the principles that must be followed in highway environmental protection, Therefore, highway environmental pollution control is a very complex and arduous task with a long and strong long-term nature. At present, the scale of highway construction in China is expanding, and a large number of environmental protection facilities are also used on highways. However, with the rapid development of highway engineering projects, the traffic volume is growing and the traffic pressure is increasing. All of these have had a huge impact on the environment and even threatened human living space, health and safety; In addition, due to some natural factors, people have already caused serious damage to the natural environment and have to stop construction or carry out other transformation, which has greatly reduced the running speed of expressways, and there will also be various traffic accidents when driving on expressways. Therefore, China needs to constantly strengthen the level of highway construction and management. From the perspective of highway construction, its environmental pollution mainly refers to the impact on the life and health of the residents along the road caused by natural environmental factors and human activities, and will also bring varying degrees of harm to the surrounding ecological environment [11, 12]. Therefore, measures should be taken to solve these problems. First of all, it is necessary to strengthen the

awareness of environmental protection. Before construction, an environmental protection plan should be formulated to restrict the behaviors of construction personnel and management personnel. The second is to establish a perfect safety protection system to protect the traffic personnel and pedestrians from being injured and deal with the accident in time when the vehicle is running. Finally, improve the living and working environment of the residents along the expressway.

2.2. Necessity of Expressway Natural Environment Protection Technology

In China, with the continuous improvement of social economy and scientific and technological level, people have higher and higher requirements for the quality of life. As an integral part of the transportation system, highways are also facing increasingly serious challenges: on the one hand, due to the large traffic volume and relatively short transportation distance, on the other hand, due to the complex terrain and other factors, the road environment has become worse and more complex, which has gradually become a problem that needs to be solved and improved urgently [13, 14]. Expressway is a special mode of transportation. Its main transportation feature is that it has strong seasonality, and it is easy to cause traffic jams in severe weather such as cold winter, high temperature and rainy summer. Therefore, in order to avoid these situations, it is necessary to strengthen the research on expressway natural environment protection technology and construction management. First of all, it should be noted that the environmental protection materials and mechanical equipment used in the road construction will be polluted or affect the natural environment. Second, the air pollution that may occur during the road construction will also seriously threaten the quality and safety of the ecological environment. At the same time, due to the large population and low per capita resources in China, haze weather occurs frequently. However, with the continuous progress of society and the improvement of science and technology, the traditional highway management mode can no longer meet the requirements of highway environmental management at this stage, and can not effectively control the frequency and harm of traffic accidents. The natural environment protection technology of expressway can improve people's quality of life and promote the economic development of our country. In the process of expressway construction, the characteristics of long construction period and large investment of highway engineering have caused serious impact on it [15, 16]. Therefore, advanced means are needed to ensure traffic safety.

2.3. Artificial Neural Network Prediction Technology

Artificial neural network prediction technology is a system that simulates the natural environment. It can be continuously improved according to the actual situation, and can adapt to various complex changes. It plays a very important role in the analysis of expressway projects [17, 18]. This method is mainly used to study various kinds of information and data needed in the process of highway construction. Through the establishment of mathematical relationship between these data and data, the prediction function is integrated with the simulation of natural environment, so as to effectively control the pollutant gas and noise emissions during road construction. Figure 1 shows the principle of artificial neural network prediction technology.

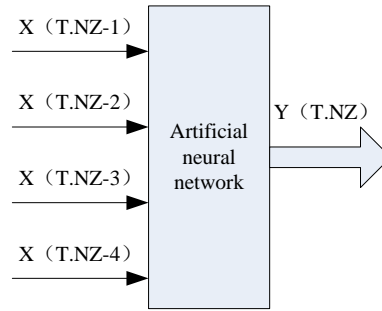


Figure 1. Artificial neural network prediction techniques

Artificial neural network is a nonlinear system that simulates the human brain. It is based on biological neurons and realizes information transmission by processing input and output signals. It is advanced, reliable and simple, and has strong prediction ability. It can quickly and accurately analyze and evaluate road traffic. This method is mainly applied to the statistical prediction of road traffic accidents. Its basic principle is as shown in Figure 1. When building a model to simulate the laws of traffic state changes under natural weather conditions and the forces generated by the interrelationships between influencing factors and other related theoretical knowledge, it is found that the artificial neural network can use a variety of sensor signal characteristics and convert them into corresponding forms of data processing systems.

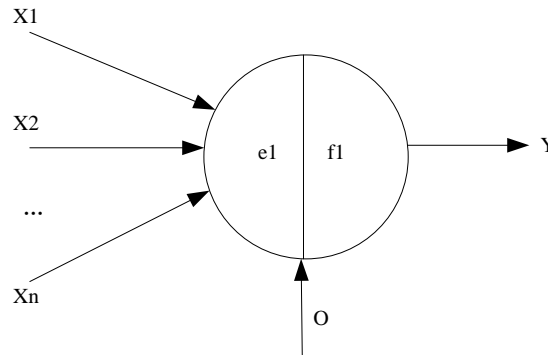


Figure 2. The structure of the bp algorithm

In order to overcome the shortcomings of BP algorithm itself, such as slow convergence speed and minimum point of objective function, Levenberg Marquardt algorithm with fast convergence speed and high calculation accuracy is used to train the network. Select the 3-layer BP network structure (as shown in Figure 2), set the input layer node, and the hidden layer node h outputs the layer node J_e ; Hidden layer node threshold θ , Input layer node, threshold value θ , connection weight w between input layer and hidden layer node, and connection weight w , t between hidden layer and output layer node are expected outputs. The steps to derive the algorithm are as follows:

- 1) Select the initial weight value w .
- 2) Input the corresponding predictor information (x_1, x_2, \dots, x_m) for all training samples.
 - a. Calculate hidden layer node output:

$$h_j = f \left(\sum_{i=1}^m \omega_{ij} x_i - \theta_j \right) \quad (1)$$

- b. Calculation output layer node output:

$$y_k = f \left(\sum_{j=1}^p \omega_{jk} h_j - \theta_k \right) \quad (2)$$

The BP algorithm mainly includes two steps: first, establish the data set and compare it with the actual predicted value; second, calculate the optimal parameter value and the corresponding iteration number and other related parameters after preprocessing to finally determine the network structure model and connection relationship, pattern recognition, learner selection and other contents; finally, analyze and judge the input and output signals, so as to realize the automatic decision-making function of the simulated human brain neural network.

3. Experimental Process of Expressway Natural Environment Protection Technology

3.1. Natural Environment Protection Technology Management Framework Based on Expressway

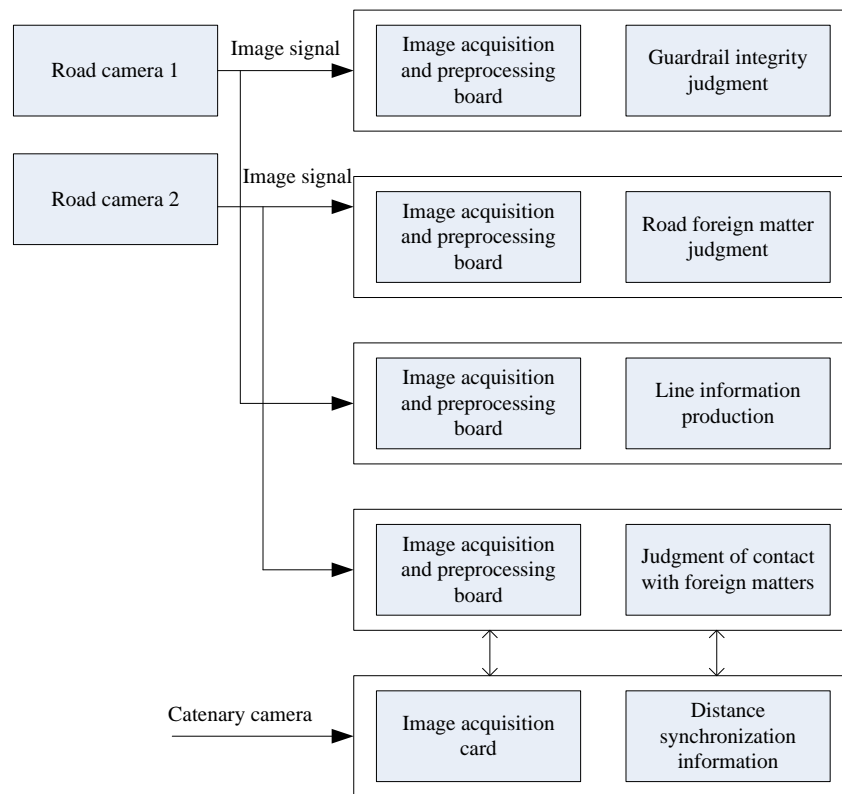


Figure 3. Technical management framework of natural environment protection based on highway

The framework (as shown in Figure 3) includes the design, construction and maintenance of environmental management and traffic engineering. When planning the expressway environmental protection project, the terrain and landform along the line should be fully considered, and the road grade and scale should be determined in combination with the characteristics of highway construction and natural geographical conditions. Secondly, the formulation of the expressway environmental protection technical scheme should follow the scientific and practical principles, According to national regulations and relevant laws and regulations, relevant standards are formulated to evaluate the natural environment around the road. The specific location of the road section is determined by analyzing and studying the existing traffic facilities and the surrounding

road network, as well as whether the driving routes of passing vehicles meet the design requirements. At the same time, these data can also be converted into computers by using advanced technical means for real-time monitoring. Finally, according to the actual situation, the design scheme and construction process flow that meet the requirements and are economical and applicable are formulated.

3.2. Experimental Test of Natural Environment Protection Technology Management Framework Based on Expressway

After the expressway environmental quality inspection under natural environment conditions, it is necessary to inspect it. Through experiments, analyze whether there are problems in the road surface condition under the influence of different parameters and the change of highway traffic volume. Secondly, determine the corresponding control target values and design indicators according to the test results, and feed back the data to the relevant departments or organizations to make improvement measures and decision-making suggestions. Finally, provide technical support and reference for the comprehensive treatment of highway environmental pollution.

4. Experimental Analysis on Expressway Natural Environment Protection Technology

4.1. Experimental Test Analysis of Natural Environment Protection Technology Management Framework Based on Expressway

Table 1 shows the test data of expressway natural environment protection technology.

Table 1. Test of highway natural environment protection technology

Test module	Predicted value	Actual value	Error rate (%)
Guardrail monitoring module	45	43	4
Camera monitoring module	34	31	8
Information storage module	25	24	4
Road Handicorders Monitoring Module	56	53	5



Figure 4. Experimental test of natural environment protection technology

Management framework based on HighwayThis paper adopts the method of combining theory with practice, using natural environment protection technology and ecological engineering to test

the expressway. The first is the natural protection system experiment. A road construction, operation management mode and related facilities in a simulated environment are set up in the natural environment to investigate its feasibility. The ecological environment evaluation index system is studied and analyzed. The evaluation standard value, evaluation range and related parameter value are determined after establishing a model and drawing corresponding conclusions based on the actual situation, which can be drawn from Figure 4, This nature protection technology can accurately monitor the road conditions of the expressway, and then calculate the comprehensive benefit index of the ecological project according to the obtained data, so as to carry out the economic and social impact of the expressway project.

5. Conclusion

With the development of economy and the improvement of social civilization, expressway construction has become an indispensable part of China's modern transportation system. As an important part of highway transportation network system, natural environment protection technology is of great significance in promoting regional harmony and ensuring traffic safety. This paper mainly studies the contradictions and solutions between road greening project and ecological protection measures from the aspect of natural environment, analyzes the problems and countermeasures that should be paid attention to in the process of road greening construction and highway environmental pollution prevention methods based on the current situation of natural ecological environment, and expounds them, and puts forward relevant suggestions for reference.

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Data Availability

Data sharing is not applicable to this article as no new data were created or analysed in this study.

Conflict of Interest

The author states that this article has no conflict of interest.

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