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Research on Application of Chain-pole Equilibrium Model to Highway Environmental Assessment

LI Pan-wu , GAO Lang *

School of Civil Engineer, Chang'an University, Xi'an 710061, Shaanxi, China

Abstract

According to the current situation of the development of the China's highway environmental assessment and the existing problems, from the two aspects, the environment itself and people's control over the environment ,which effect the quality of highway environmental assessment tremendously, this paper analyses the main influence factors of the two aspects by using decision tree of mathematical thinking, and studies the application of equilibrium management model to highway environmental assessment. The result of the study shows that: the use of the number of comprehensive ability to assess the impact on environment of the highway engineering project, not only makes the sensitive area can be special treated, but also makes the optimized configuration of resources.

Keywords: decision tree; equilibrium management; environmental assessment; the number of comprehensive ability.

1. Introduction

As a fundamental industry of national economy, highway construction to a region of the political, economic and cultural development plays an important role in promoting. However, along with the rapid development of highway construction, highway pollution and the impact of environment to their surrounding and other issues are gradually exposed. How to properly deal with the environment problems because of highway construction; how to analyze and evaluate the effect and impact to the environment

* Corresponding author. Tel.: +1-357-207-2892; fax: +1-357-207-2892.
E-mail address: jiyu_1997@126.com.

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of each phases of highway construction; how to take effective measures to reduce or eliminate highway environmental pollution, compensate ecological damage; it is all particularly important.

Environmental impact assessment is an important task of environmental protection, it is an effective means and methods of implementing the strategy of sustainable development in decision-making and developing construction activities [1]. The United States is the first to fix down the environmental impact assessment in legal form and establish environmental impact assessment system. Environmental impact of highway construction in China of a late start to 1987, "Xi'an to Lintong Expressway environmental impact assessment report" as a sign of it, which compiled by the Xi'an Highway Scientific Academy, along with China's economic and social development is increasingly improved[2][3]. However, the current environmental assessment of highway construction projects still exists many problems in China, such as environmental impact assessment often lag behind the design scheme [4], the integrity of the assessment is not strong, the depth of the assessment is not enough, the attention of sensitive area is not enough and so on, it is all making the prediction function and guidance function of highway environmental impact assessment greatly reduced [5], did not play its due role. Therefore the application of appropriate methods of highway environmental impact assessment is particularly important. This paper studies the application of equilibrium management model [6] [7] [8] in highway environmental assessment, which can effectively solve the problems existing in the current environmental assessment, also can improve the quality of the environmental assessment [9].

2. The chain-pole equilibrium management model

2.1.The theory of chain-pole equilibrium management model

The construction of highway engineering project can cause negative effects to the air, water and ecological environment of where the project is located, therefore it needs to take some effective measures to minimize these negative effects, and even produce some positive effects. Through the analysis of the factors in environment assessment, and concludes the decision tree [6] [10] figure as following figure1.

In the adjacent sections of highway, through the decision tree diagram to know the main factors that impact highway environmental assessment , and then build the chain-pole equilibrium management model, and then calculate out the comprehensive ability number of the environment and people's own ability to control the environment of each road section. In order to be able to make existing resources can get reasonable configuration, at the same time, emphasize the key regional evaluation, the comprehensive ability number of adjacent road section should be equal.

2.2.The chain-pole equilibrium management model

In the comprehensive consideration of the realistic situation, on the basis of considering the balance between the environment and people's own ability to control the environment of each road section, with the idea of rationally configuration of resources, and a sensitive area should be treated specially, so that we can get a better environment assessment.

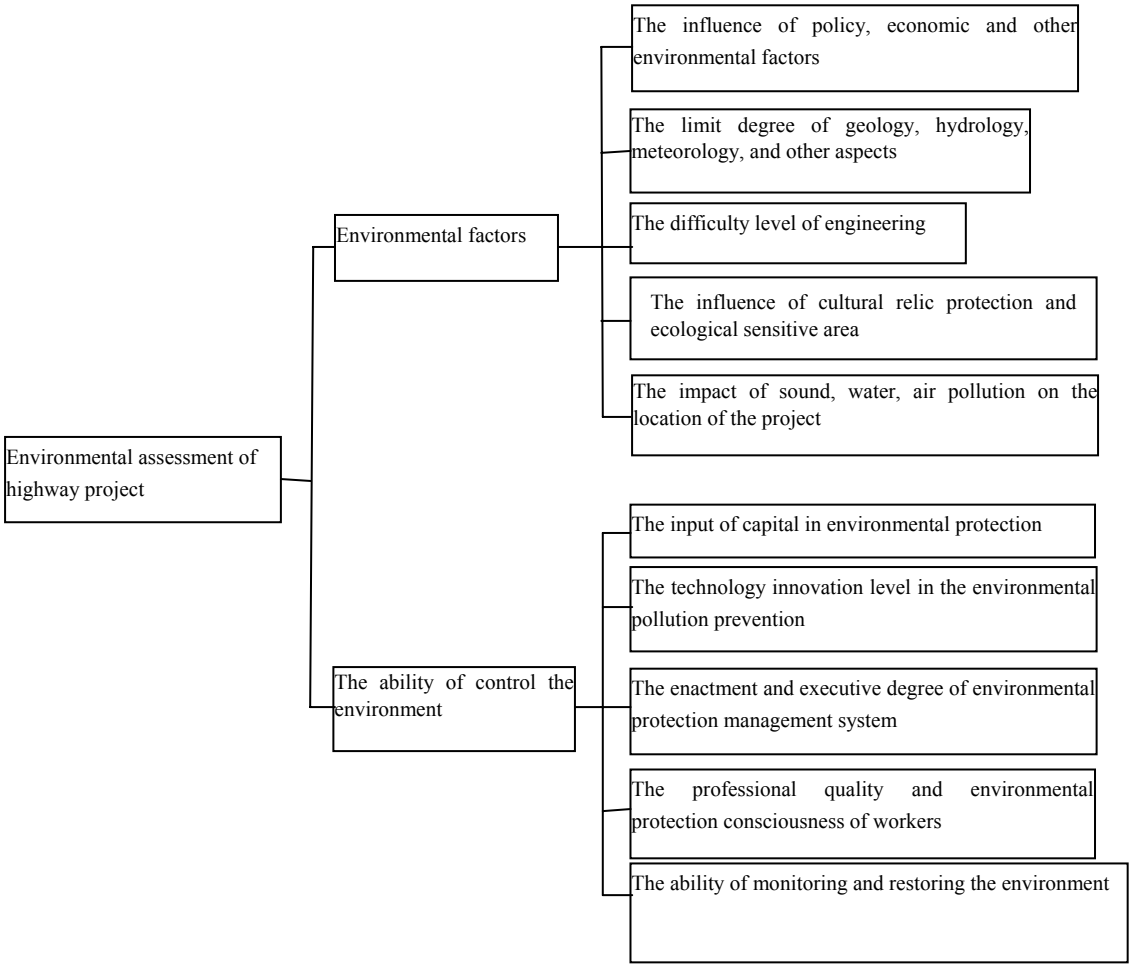

Fig. 1.The main factors in environmental assessment of highway project

In practice, it can use the method that the comprehensive ability number of adjacent road section should be equal. Specific methods are as follows:

The formula of the application of chain-pole equilibrium model to highway environmental assessment:

$$(SC)\ i = (SC)\ p\text{-}e / (SC)\ e \quad (1)$$

$(SC)_i$: The comprehensive ability number of people to road section i

(SC) e: The comprehensive ability number of engineering limit by environmental factors

$$(SC)\ p\text{-}e = A_1 B_1 C_1 D_1 E_1 \quad (2)$$

A_1: The input of capital in environmental protection (the number is based on the input of capital: more 7, general 5, less 3)

B_1: The technology innovation level in the environmental pollution prevention (the number is based on the good or bad grade: good 9, fine 7, middle 5, bad 3)

C_1: The enactment and executive degree of environmental protection management system (the number is based on the effective degree of enactment and execution: effect is obvious 6, effect is general 4, basically had no effect 2)

D_1: The professional quality and environmental protection consciousness of workers (the number is based on the good or bad grade: good 10, fine 8, middle 6, bad 4)

E_1: The ability of monitoring and restoring the environment (the number is based on the grade of ability: very strong 9, strong 7, general 5, weak 3)

$$(SC)\ e=A_2B_2C_2D_2E_2 \quad (3)$$

A_2: The influence of policy, economic and other environmental factors (the number is based on the influential degree: serious 6, general 4, slight 2)

B_2: The limit degree of engineering road section i by geology, hydrology, meteorology, and other aspects (the number is based on the limit degree: serious 7, general 5, slight 3)

C_2: The difficulty level of engineering road section i (the number is based on the difficulty level of engineering: very difficult 8, difficult 6, general 4, easy 2)

D_2: The influence of cultural relic protection and ecological sensitive area (the number is based on the influential degree: very serious 7, serious 5, general 3, slight 1)

E_2: The impact of sound, water, air pollution on the location of the project (the number is based on the influential degree: very serious 8, serious 6, general 4, slight 2)

When it is balanced, for the adjacent road sections, there are $(SC)\ i = (SC)\ j$, i , j in the equation respectively refer to the i, j road section of the project.

3. Engineering example

A highway project, which connected the two sections are A, B, the parameters of sections A, B are as follows:

Table 1.the parameters of sections A, B

factors	Section A	Section B
The influence of policy ,economic and other environmental factors	4	2
The limit degree of geology, hydrology, meteorology, and other aspects	3	5
The difficulty level of engineering	4	6
The influence of cultural relic protection and ecological sensitive area	3	1
The impact of sound, water, air pollution on the location of the project	6	8
The input of capital in environmental protection	7	5
The technology innovation level in the environmental pollution prevention	9	7
The enactment and executive degree of environmental protection management system	6	4
The professional quality and environmental protection consciousness of workers	6	8
The ability of monitoring and restoring the environment	4	6

Calculation process as follows:

3.1 The calculation of (SC) p-e:

*(SC) p-e $_A$=7*9*6*6*4=9072*

*(SC) p-e $_B$=5*7*4*8*6=6720*

3.2 The calculation of (SC) e:

*(SC) e $_A$=4*3*4*3*6=864*

*(SC) e $_B$=2*5*6*1*8=480*

3.3 The calculation of (SC) $_i$

$(SC)_A$= (SC) p-e $_A$/ (SC) e $_A$=9072/864=10.5

$(SC)_B$= (SC) p-e $_B$/ (SC) e $_B$=6720/480=14

It is obvious, *(SC) $_A$ ≠ (SC) $_B$*

3.4 The adjustment

There are two ways, one is with the comprehensive number of section A as the base, adjust the comprehensive number of section B; another is to take the average for base, adjust the comprehensive number of two sections. In this example, with the comprehensive number of section A as the base, adjust the engineering parameters of section B, such as lower the professional quality and the environmental awareness to six by transferring away some workers who have higher professional level.

4. Conclusion

Through the above project examples, we can see that the application of chain-pole equilibrium model to highway environmental assessment not only makes the sensitive area can be special treated, but also makes the optimized configuration of resources. Thus it can be seen, the application of this model to highway environmental assessment has significant meaning.

(1)Application of chain-pole equilibrium management model can quickly calculated comprehensive ability number of each section, and according to its respective comprehensive ability number to judge the sensitive area whether to be treated specially, existing resources whether to be optimized configured.

(2)According to the comprehensive ability number, we can adjust the resources configuration of each section quickly, making resources to get a better configuration in whole sections, so as to get better environmental assessment.

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