A Study on the Performance-based Evaluation Techniques of Tunnel In Use

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ABSTRACT

The proportion of infrastructure using for more than 30 years is expected to be increased as construction projects of infrastructure have been rapidly growing since 1970s. The maintenance of the infrastructures is essential, because aging of infrastructure can lead to its collapse and it can seriously damage the national economy and people. The existing evaluation method of tunnels in South Korea has many limitations to consider the tunnels’ various performances (e.g. durability, usability etc.), because the existing method is mainly focused on the structural safety such as appearance defects or safety factors. Hence, the development of the new concept of evaluation method is needed to deal with the structure aging issues and to keep the tunnels performances continuously. The change of paradigm to performance-Based evaluation system is an effective way to invest limited finance. In this paper, the research of the performance-based evaluation technique of tunnels was conducted to improve the existing maintenance system in South Korea.

KEY WORDS: Performance; Infrastructure; Evaluation Items; AHP (Analytic Hierarchy Process); Delphi-Method

INTRODUCTION

As the infrastructure is the key measure to represent nation’s competitiveness, its design and maintenance is very important for people to protect their life and develop national economy. Lately, many countries such as the United States, Canada and South Africa are trying to switch the maintenance system from Safety-critical maintenance to performance-based maintenance. They are presenting the performance grade of the infrastructures every four years by serving the Report Card. The performance grade of each infrastructure has been used for the political decision and the strategic maintenance. In order to estimate the performance grade of infrastructure, the comprehensive evaluation method is required by considering the physical conditions, capacities and life spans of infrastructure. In addition, to meet the target performance of infrastructure, investment strategy and maintain strategy has to be set for the effective maintenance. The infrastructures that are over 30 years in use have constantly been increasing. The collapse of infrastructure will bring a blow to the economy and quality of life in the city (Adam Forman, Mar, 2014.). Moreover, the infrastructure age often acts together with and may reinforce the effect of other factors such as design, maintenance, and operation in increasing the vulnerability of infrastructure to these various threats (R.Zimmerman; C.E, Restrepo; J.S. Simonoff, 2010).

South Korea has established the ‘Special Act on Safety Management of Facilities’ for facilities management and by this Act, facilities has been separated and maintaining. It has specifically enacted as a law after the huge accident that is Sung-Soo bridge collapse. It is similar cases such as the ‘The Post Katrina Emergency Management Reform Act of 2006’ enacted after damage of Hurricane Katrina in the USA and ‘Act on the Promotion of Earthquake-Resistant Repair of Buildings’ enacted after Kobe earthquake in Japan.

However, the current maintenance system of tunnel in South Korea has been mainly focused on the safety and strived to prevent accident by restoring the damaged areas. It is an accident preventive maintenance for repairing the damaged structures. Therefore, it is needed to switch over to the performance-based maintenance, which can analyze the infrastructures’ age, usage etc.

In this study, we have performed a research to make up for the shortcomings of the current maintenance system of tunnels in South Korea and develop new concept's maintenance system of tunnels.

A research carried out as follows:

The first, a study about required performance for estimating the performance of tunnel in use.

The second, a study about performance evaluation index for estimating the performance of tunnel in use by the Delphi-Method.

The third, a study about the weight of each performance evaluation index by AHP analysis.

The forth, a study about guidelines to the performance evaluation.

Finally, presenting the comprehensive performance evaluation procedures of tunnels in use.