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The Application of Composite Index in Pavement Engineering

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Abstract:

Due to the rapid expansion of our domestic highway networks, the demands for pavement maintenance and rehabilitation (M & R) activities are increasing dramatically. Proper selections of M & R activities can extend pavement service life to assure the best use of our limited resources. The major objective of this study is to conduct an in-depth investigation on the application of composite index in pavement engineering.

The current practices of domestic pavement M & R activities are first reviewed. The fundamental concepts and evolutions of several structural and functional evaluation indices including Present Serviceability Index (PSI), Maysmeter Output (MO), International Roughness Index (IRI), Pavement Condition Index (PCI), and Pavement Surface Distress Index (PSDI) are investigated. It was found that our domestic practices did not quite follow the global trends of objectivity, simplification, automation, and standardization in using composite indices. Consequently, the relationships, advantages, and deficiencies of both PCI and PSDI are compared in this study. The results indicate that PCI is more preferred due to its measuring ability, replicability, objectivity, and consistency. Toward standardization is also one of the major concerns for using the PCI.

Together with the utilization of "uniform sections" and "sampling" concepts, an automated project-level PCI prototype program with well-organized Windows-based graphical user interfaces was developed using Microsoft Visual Basic 6.0 program. Several case studies are conducted to validate the correctness of this prototype program through comparisons of manual calculations and the results of the well-known MicroPaver program. To illustrate the application of the PCI, this program is also implemented in the existing prototype Intelligent Consultant System for Pavement Maintenance And Rehabilitation Technologies for Rigid Pavements (ICSMART-R) and for Flexible Pavements (ICSMART-F), and NETWORK Dynamic Segmentation Database (NETDSD) programs for both project level and network level pavement management, respectively. Due to the large amount of data required to determine the PCI, it is not recommended for use in the current domestic network pavement management activities.

Several recommendations for carrying out domestic pavement evaluation activities including ascertaining management levels, data requirements, selection of composite indices, personnel and training, automated distress survey and devices, selection of M & R criteria, and pavement performance models are discussed.

Keywords: pavement evaluation, maintenance, rehabilitation, composite index, PCI.