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Development of a Prototype Intelligent Consultant System of Maintenance and Rehabilitation Techniques for Flexible Pavements

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Abstract:

Taiwan's Pavement Maintenance Management System (PMMS) was originally developed under the ideal framework of total pavement management system, whereas the pavement network is defined by thousands of very short "fixed-length sections." After approaching 20 years of system implementation, the PMMS can barely meet the needs for "network-level" as well as "project-level" management purposes till now due to extreme difficulties in the requirement of mass data collections and compilations. Thus, the primary objective of this study is to develop a prototype Intelligent Consultant System for Pavement Maintenance And Rehabilitation Technologies for Flexible Pavements (ICSMART-F).

Since there exists no standardized evaluation procedure for pavements in the current Taiwan's PMMS, this study first proposed a distress identification manual for flexible pavements based on the Long-Term Pavement Performance (LTPP) definitions and domestic considerations. The concepts of "uniform sections," "project-level" management, as well as the integration of a computerized Knowledge-Base Expert System (KBES) were adopted in this study. Many decision trees and prediction models for pavement structural and functional evaluation from various literatures were obtained and modified according to domestic pavement performance and construction practices. The levels of data requirements were emphasized and the concept of dynamic decision trees was also introduced.

Consequently, a prototype ICSMART-F program was developed using many Windows-based graphical user interfaces. This prototype system currently has the basic features of the identification of pavement distresses and causes, the evaluation of present condition, the prediction of future condition prior to rehabilitation, the recommendation of rehabilitation methods and strategy, the prediction of future performance after rehabilitation, as well as the analysis of life cycle cost of the individual pavement section.

Continuous research effort is still recommended to incorporate the automated selection of preferred major and detailed rehabilitation alternatives into the prototype system. The applicability of this prototype system shall be further validated through practical case studies of domestic asphalt concrete pavement sections. This prototype system may be gradually adjusted or enhanced to reflect different local pavement performance and practices. The ultimate goal of this study is to develop an objective, accurate, and efficient way in selecting the most economical pavement maintenance and rehabilitation alternatives through such a computerized intelligent consultant system to assure the best use of our limited resources.

Keywords : Flexible Pavement, Pavement Maintenance and Rehabilitation, Project Level, Uniform Section, Expert System, Dynamic Decision Trees.