

Title of Thesis:

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

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Abstract:

Due to the rapid expansion of our domestic highway networks, the increasing demands for pavement maintenance and rehabilitation activities will become extremely challenging. The current practices in repairing deteriorated concrete pavements depend on experienced engineers and/or the suggestions of repair material manufactures. No practical standard procedure for concrete pavement maintenance and rehabilitation has been well established. Not knowing exactly the causes of pavement deterioration through a proper diagnostic system and proceeding with the repair may result in many premature failures. The performance of various concrete pavement maintenance alternatives and repairing materials are rarely well evaluated due to the lack of repair history and accumulated experiences. Thus, the primary objective of this study is to modify and expand the scope of an existing prototype Intelligent Consultant System for Pavement Maintenance And Rehabilitation Technologies for Rigid Pavements so as to develop a prototype ICSMART-R computer program for future practical trial applications.

The standard procedures of modern rehabilitation techniques for rigid pavements including the timing of rehabilitation, the characteristics of repair materials, the selection of repairing sections and equipments for construction were first introduced in this study to promote domestic maintenance and rehabilitation technologies for rigid pavements so as to improve future performance, decrease the frequency of rehabilitation, and increase the life of the rehabilitated pavement sections. The concept of "uniform sections," was properly implemented in this study. The existing Windows-based graphical user interfaces were reorganized and expanded with many new features in pavement maintenance and rehabilitation. Many decision trees and prediction models for pavement structural and functional evaluation from the well-known EXPEAR program were obtained and modified according to domestic pavement performance and construction practices. The levels of data requirements were also emphasized. This intelligent consultant system has the ability to efficiently diagnose the causes of pavement distresses, to evaluate the current pavement condition, to provide recommendations for feasible rehabilitation techniques and strategy, as well as to analyze the economical benefit, predict the pavement performance, and analyze the life cycle cost after rehabilitation.

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 jointed 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 highway resources.

Keywords: Jointed Concrete (Rigid) Pavement, Pavement Evaluation, Pavement Maintenance and Rehabilitation, Expert System, Decision Trees.