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Alternative Strategies Optimization for Pavement Network
Rehabilitation Management

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Abstract:

Due to the rapid expansion of domestic highway network, increasing demands for the planning and programming of pavement maintenance and rehabilitation activities will become extremely troublesome and time-consuming. Under the framework of Taiwan's present Pavement Maintenance Management System (PMMS), it is extremely difficult to completely collect the required but tremendous amount of pavement data so as to efficiently and optimally select various rehabilitation alternatives with limited available funding. Thus, the main objective of this study is to develop a prototype system for alternative strategies optimization for the "network level" pavement rehabilitation management of Taiwan's highways.

The concepts of "uniform section" and combined pavement index, i.e., PSR are adopted in this study. Tentative prediction models are obtained from the U.S. Highway Performance Monitoring System (HPMS) for future pavement condition prediction. Various rehabilitation selection algorithms including decision trees, life cycle cost, and single rehabilitation are adopted as similar to general network pavement management practices. Vehicle kilometer traveled, reduced user cost, added life, and average PSR are treated as benefit options. Several network optimization algorithms ranging from very simple to fairly complicated, i.e., needs, ranking, benefit-cost ratio, and incremental benefit-cost ratio are utilized for the estimation of future budget needs and the allocation and prioritization of limited available funds for pavement rehabilitation purposes.

The proposed approach has been implemented in a Windows-based computer program (TKUNET) with many user-friendly interfaces using Visual Basic software package to assist high-level pavement management officials in analyzing and answering lots of "what ... if ..." questions such as the determination of future rehabilitation needs, tabular and graphical query, network summary and presentations of optimized budget allocation problems. This prototype system requires the minimum amount of pavement data and can be further expanded with ease and efficiency so as to assure the best use of our limited resources for network pavement rehabilitation through minimum time, effort and cost.

Keywords: Pavement Management System, Network Level, Rehabilitation Strategies, Optimization, Needs Analysis, Incremental Benefit Cost Ratio, Linear Programming, TKUNET.