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Theoretical Investigation on Backcalculation of  
Pavement Layer Moduli from Surface Deflection Data

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Abstract :

Since the *elastic moduli* of pavement layers which represent the strength of pavement structure cannot be obtained directly from the *surface deflection* data measured from nondestructive testing devices. Therefore, they are usually backcalculated from some *backcalculation* procedures.

Owing to the complicated process and the theoretical limitations of backcalculation procedures, this research study focuses on the following problems: (1) The elastic moduli obtained from measured surface deflection data may be not unique. (2) There exists very few guidelines regarding to the selection of initial trial values and input data ranges which may affect the results of backcalculation dramatically. (3) The iterative backcalculation procedures are often very time-consuming and sometimes the specified convergence criteria are not satisfied.

This research first studies Scrivner's function which were derived from Burmister's deflection equation of a *two-layer system*. From this investigation, the related deflection function was uniquely identified with *dimensionless variables*. Secondly, a *data base* was constructed using this unique relationship. This data base could also be graphically represented by a series of monographs. Thus, the elastic moduli of pavement layers can be easily obtained (or "backcalculated") by graphical methods. Furthermore, this study also strives to develop prediction equations to directly and instantly calculate elastic moduli from surface deflection data using the *Projection Pursuit Regression* and traditional linear regression techniques.

Finally, the preliminary results of this thesis study were validated and illustrated through some practical examples. Their tentative practical applications were discussed and recommendations for future research were also provided.

*Key Word* : *elastic moduli, surface deflection, backcalculation, two-layer system, dimensionless variable, data base, Projection Pursuit Regression*