

IMPROVEMENT OF DYNAMIC BACKCALCULATION ANALYSIS BASED ON RANDOM SELECTION OF SEED VALUES

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Impulsive nature of FWD test demands dynamic backcalculation analysis for accurate determination of layer moduli. In this paper, development of dynamic backcalculation software called DBALM and efforts to improve its computational efficiency and accuracy are introduced.

Utilization of Ritz vector method has led to drastic reduction in computational time. Moreover, sensitivity analysis required in the backcalculation analysis was also conducted using the same Ritz vectors. Since formation of global matrices, which are composed of many element mass, damping and stiffness matrices, is computationally costly, layer damping and stiffness matrices, after the second iteration, were constructed while skipping the process of element matrices formation. Furthermore, considering that coefficient of layer damping and layer modulus of elasticity are completely different in magnitude, scaling of variables used in optimization was introduced to reduce numerical instability. Gauss-Newton method coupled with truncated singular value method was utilized to achieve numerical stability.

It has been reported in several publications that backcalculation analysis in case of thin surface layer, leads to inaccurate results. In this research, multiple sets of seed values were generated from biased and unbiased random numbers and separately used in dynamic backcalculation to determine average layer moduli. Random numbers were used to vary seed values of modulus of elasticity over a wide range in order to determine how backcalculated layer moduli would be affected. Results indicated that acceptable mean layer moduli were obtained for various types of pavement structures considered, including thin surface layers.

Discussions of results were based on simulation and actual FWD data as well as static backcalculation analysis.