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955 Park Street
P.O. Box 191
Columbia, SC 29202

Feasibility of Including Structural Adequacy Index as an Indicator of Overall Pavement Quality in the SCDOT Pavement Management System

This report summarizes a study to assess the feasibility of including a deflection-based Structural Adequacy Index (SAI) in the South Carolina Department of Transportation (SCDOT) Pavement Management System (PMS). The investigation included a survey of other state highway agencies, a literature review, and a review of project-level Falling Weight Deflectometer (FWD) data currently on file within the SCDOT. The investigation also included a review of the SCDOT PMS, its extent and function, the pavement quality models used, the current PMS software's ability to include a structural condition component in pavement quality assessment, and past SCDOT experience with Structural Adequacy Index. For three Interstate Route test sections, example SAI computations are presented and SAI values are compared with PMS pavement quality assessments.

The SCDOT has a well-established and successful PMS. The SCDOT PMS currently includes South Carolina's Primary Road System and the SCDOT is currently initiating a Secondary Pavement Management System for South Carolina's Secondary Road System. The PMS uses a Pavement Quality Index (PQI) to quantify pavement condition based on surface distress and wheel path roughness. The PQI is a composite index computed using Pavement Distress Index (PDI) and Present Serviceability Index (PSI). PDI is computed using a non-linear model and surface distress data obtained by keyboard/windshield surveys. For bituminous and composite pavements (bituminous over concrete), profiler-obtained rut depth data are also used in the computation of PDI. PSI is computed using an exponential model and International Roughness Index (IRI) values derived from wheel path profiles obtained using non-contacting inertial profilers. The SCDOT PMS does include a provision for including a deflection-based SAI as a component of PQI. However, the SCDOT currently does not conduct any network-level FWD testing or utilize SAI. The SCDOT currently has three data collection vans. In-house collection of PMS data began in 1994. The PMS software used by the SCDOT Pavement Management Unit was developed by Stantec Consulting Inc. (formerly Pavement Management Systems Inc.).

The SCDOT has two Falling Weight Deflectometers and well-established procedures for FWD testing and analysis of bituminous pavements. The analysis procedures predict current Structural Number (SN_{xeff}). SN_{xeff} and predicted future traffic can be used to estimate remaining life and SAI. The SCDOT has been performing project-level FWD testing since 1992.

Based on a survey of state highway agencies and a literature review, it appears that although incorporation of network-level deflection analysis is a worthwhile and technically sound undertaking, there are few agencies that use deflection-based structural assessments in their Pavement Management Systems. Reasons include lack of resources to perform network-level FWD testing and lack of confidence in available traffic data. Other reasons may be the impracticality of performing mechanistic deflection analyses at the network level and/or the lack of simpler (more empirical) agency-developed deflection analysis procedures.

The study concludes that inclusion of a deflection-based SAI into the SCDOT is currently feasible at the network level for bituminous Interstate Routes. The addition of a separate deflection-based structural assessment would be valuable for identifying structurally weak sections, developing rehabilitation strategies based on structurally homogeneous sections, and, once a database has been established, for evaluating the structural performance of pavements.

The study recommends that a pilot network-level FWD testing program be implemented. It is recommended that this program include all bituminous Interstate Routes and that FWD deflection and other relevant data to SAI be included in the PMS. As a minimum, this effort will provide a baseline of structural capacities of in-service pavements. Data generated by the pilot study should be useful for determining how best to quantify structural capacity and would serve as an initial database for formulating a meaningful SAI model.

This research project was conducted at the University of South Carolina by Ronald L. Baus, Ph.D., Charles Pierce, Ph.D., and Wei Hong.
For further information, contact Terry Swygert at SCDOT: (803) 737 6652; swygerttl@dot.state.sc.us