

Expanding the Concept of Comprehensive Area Ratio Parameter to the South-Central States: Towards Simplifying the Structural Evaluation of Flexible Pavements at the Network Level

Developing a simple, efficient method for assessing flexible pavements' conditions at the network level

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20PUTSA34

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\$120,180

South-Central State DOTs and local highway agencies across the nation, collect nondestructive deflection test (NDT) data at the highway network level to identify weak pavement sections that require further analysis at the project level. Among the various NDT utilized, Falling Weight Deflectometer (FWD) test is one of the most common tests in judging the properties of a flexible pavement, although, appropriate procedures for identifying structurally weak pavements utilizing FWD data at the network level are lacking. A simple, feasible method is a need of various DOTs. One of the direct methods developed in judging structural conditions of the pavement sections is the procedure developed in Project No. 17PUTA02. Many criteria were developed under that project which were useful in numerically ranking pavement sections at the network level from very strong to very weak. The aforementioned project used pavement sections in the State of Texas to determining their structural conditions. The outcomes of the project can potentially be expanded to all the South-Central State DOTs. This analysis will give a more reliable assessment of the actual structural condition of the highway network. This will give South-Central state DOTs and local highway agencies asset management a better view of the highway network condition; therefore, they can provide better estimation of the needed funds to maintain the highway network at certain levels. Consequently, better management and allocation of the resources is possible. Additionally, with reliable evaluations of the structural condition of the highway network, the pavement preservation methods will be apportioned to structurally sound pavements while rehabilitation and reconstruction will be given to structurally poor pavements.

level. However, this method is complex and inefficient. It also requires the knowledge of layer thicknesses that are not commonly collected at the network level, thus making this technique impractical. Therefore, there is a need of an innovative method to determine and validate the structural condition of pavement sections at the network level for all the South-Central States.

Objectives

The specific objectives of the project are as follows:

Task 1: Compile all related literature review. This task is intended to include a compilation of related literature review to identify a varied perspective on several structural indices such as, deflection and deflection bowl area parameters concepts to evaluate pavement structural capacity. This will include a detailed review of the CAR' methodology developed in Project No. 17PUTA02.

Task 2: Deflection and pavement condition data extraction from LTPP. This will be followed by collecting pavement section data as well as FWD information for a wide range of pavement structures from Arkansas, Louisiana, New Mexico, and Oklahoma State DOTs PMIS database as well as other regional or national resources to calibrate and validate the CAR' methodology developed by computer simulation.

Task 3: Computer simulation for FWD for the most common flexible pavement structures. The FWD data collected will be simulated and the deflection bowls will be computed using a multilayer elastic and/or finite element software package(s). These computer simulations using mechanistic pavement design will then be used to develop the maximum and minimum limits for various pavement conditions (i.e., poor, fair, good, and very good).

Task 4: Derivation of deflection parameters from the computer simulated data and from LTPP data. The simulated deflection bowls will be utilized to derive the required deflection bowls and CAR' for each simulated pavement section.

Problem Statement

Back-calculation from known pavement data has been used to estimate the pavement layer moduli and determine the overlay thickness at project



Measured deflection bowls and CAR' from LTPP data will be compared to the simulated parameters.

Task 5: Develop a scale to classify the structural capacity for different pavement categories. Using the output of Task 4, the final product should establish a simplified structural scale for the common flexible pavement categories in which pavement sections can be ordered according to the strength/stiffness of the pavement structure and the strength/stiffness of subgrade support.

Intended Implementation of Research

Workforce Development: This will be achieved directly by training graduate, undergraduate, and high school students interested in pursuing a career in STEM or Transportation Engineering career.

Education: This task supports the federal initiative to build the next generation of transportation professionals to meet the demands of the rapidly changing 21st-century transportation system and its evaluation practices.

Outreach: Technical articles, posters, and presentations will be delivered at national and local conferences and symposia such as ASCE, Transportation Research Board, TxDOT, and Tran-SET.

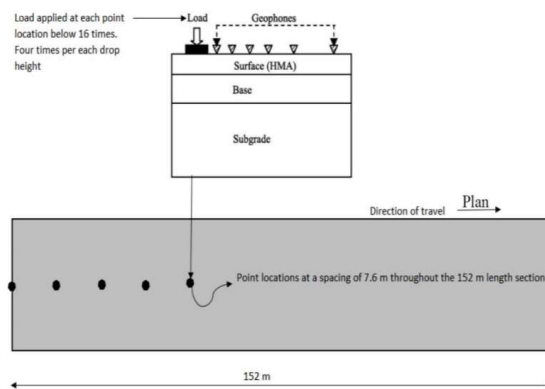


Figure 1: Illustration of the number of FWD test conducted at different point locations

Anticipated Impacts/Benefits of Implementation

The main deliverables from this study are:

(1) A final report containing the problem description, proposed solution, data, procedures,

and recommendations. The report will be available on Tran-SET's website.

(2) Webinars to disseminate the findings of this study to a national audience via American Society of Civil Engineers (ASCE).

Web links

- Tran-SET's website <https://transet.lsu.edu/research-in-progress/>

Tran-SET

Tran-SET is Region 6's University Transportation Center. It is a collaborative partnership between 11 institutions (see below) across 5 states (AR, LA, NM, OK, and TX). Tran-SET is led by Louisiana State University. It was established in late November 2016 "to address the accelerated deterioration of transportation infrastructure through the development, evaluation, and implementation of cutting-edge technologies, novel materials, and innovative construction management processes".

Learn More

For more information about Tran-SET, please visit [our website](#), LinkedIn, Twitter, Facebook, and YouTube pages. Also, please feel free to contact Dr. Momen Mousa (Tran-SET Program Manager) directly at transet@lsu.edu.

