**Research Project**

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**C a p s u l e**

*Technology Transfer Program*

**LTRC**

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# Mechanistic Flexible Pavement Overlay Design Program

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## Problem

The current LADOTD overlay design method uses estimated values for existing pavement strength. To perform the overlay thickness design, a pre-assigned (based on the parish map), typical subgrade resilient modulus ($M_r$) value and estimated layer coefficients of existing pavement layers are used as inputs in the DARWin computer program. This practice can lead to errors since the values do not represent actual field conditions.

Non-destructive deflection tests (NDTs), such as the Falling Weight Deflectometer (FWD) and Dynaflect, have gained popularity because they can assess structural integrity and estimate the elastic moduli of in-place pavement systems. Therefore, NDT technologies would allow overlay designs to be based on in-place conditions of a pavement structure and become more realistic and cost-effective.

More importantly, with the back-calculated layer moduli from NDT deflection measurements, the Mechanistic-Empirical (M-E) design approach may be directly applied to the overlay design. The M-E based pavement design approach, which links the critical

*The use of NDT devices in flexible pavement overlay design*

stress or strain of a pavement to the resulting damages, is generally believed to provide more cost effective thickness design than other empirical-based methods.

## Objectives

The objective of this project is to establish a methodology for flexible pavement overlay design in Louisiana using NDT methods, i.e., the Falling Weight Deflectometer and/or Dynaflect. This overlay design methodology can be either purely mechanistic-based (i.e., tolerable deflection method) or M-E based.

## Description

The researchers will first select six flexible pavement test sections as overlay candidate pavements in the first phase of this research: three in-service roads (at least one with high traffic volumes) and three completed test lanes at LTRC's Pavement Research Facility (PRF). FWD and Dynaflect tests will be performed during summer time when pavement structures are at the weakest load capacity (e.g., weak subgrade, low asphalt concrete modulus, etc.). Pavement mid-depth temperatures will be continuously monitored. NDT tests on in-service test sections will be performed at a minimum of 20 measurements per mile. After testing, full-depth field cores will be taken on each test section for layer thickness measurements.

Overlay thickness design for each test section will be performed using both the current LADOTD pavement design method and a suite of different NDT based overlay design procedures/software developed and used by other states and agencies. Those NDT based overlay design procedures/ software, which will be identified through a comprehensive literature search and telephone survey among different state transportation agencies, can be either purely mechanistic-based or M-E based methods. The empirical relationships used in different mechanistic-based or M-E based methods will be investigated in detail and customized for Louisiana pavement conditions (e.g., wet subgrade, coarse Superpave mixtures, and etc.). Based on the overlay thickness evaluation results, one or two flexible pavement overlay design procedures that may be customized for Louisiana conditions, will be recommended for flexible pavement overlay thickness design using NDT methods.

In Phase II, 15 project sites that are scheduled for flexible pavement overlay will be selected in coordination with LADOTD pavement design engineers. These sites will be strategically located throughout the state to encompass various weather and subgrade conditions and different roadway classification types. Based on NDT data collected from each project site and other information obtained from LADOTD, such as traffic prediction and environmental conditions, the overlay thickness design will be performed using the overlay design procedure recommended in Phase I. A set of overlay thicknesses will be recommended for each project due to the variation of in situ pavement structural conditions. LADOTD pavement design engineers will then select which thickness to implement for each project. After construction, each project site will be monitored and evaluated through NDTs, profile measurement, and visual survey every two months for one year. A long-term monitoring program will also be scheduled and conducted.

## Implementation Potential

This research will provide LADOTD with a mechanistic overlay design procedure using NDT techniques. This method is expected to greatly improve the Department's overlay design practice by using the appropriate overlay thickness to address site conditions. LADOTD can save money while also increasing pavement longevity.