# RESEARCH PROJECT CAPSULE [19-1P]

July 2018

TECHNOLOGY TRANSFER PROGRAM

# Application of Mechanistic-Empirical Pavement Design Approach into RCC Pavement Thickness Design

## JUST THE FACTS:

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*30 months*

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## POINTS OF INTEREST:

*Problem Addressed / Objective of Research / Methodology Used / Implementation Potential*

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## PROBLEM

Roller compacted concrete (RCC) is a stiff, low-slump concrete mixture that is placed with modified asphalt paving equipment and compacted with vibratory rollers. A recently completed accelerated pavement testing study showed that thin RCC pavements (4-6 in.) built over an 8.5-in. soil cement base can provide outstanding load-carrying capacity with excellent field performance and construction cost savings over an asphalt pavement alternative for a rural low-volume roadway design in Louisiana where heavy and overloaded trucks are often abundant. With proper mix design, improved paving/compaction methods, and surface texturing techniques, RCC is steadily becoming the choice for many pavement applications.

However, existing RCC pavement design procedures (e.g., PCA and USACE) are only applicable for heavy industrial pavements with thickness of 8 in. or more. Currently, there are no mechanistic-empirical (M-E) procedures for structural design of RCC pavements. As the Louisiana Department of Transportation and Development (DOTD) transitions from the 1993 AASHTO pavement design procedure to the newly-calibrated Pavement ME methodology, there is a need to develop M-E thickness design procedures for RCC pavement applications.

## OBJECTIVE

The objectives of this research are to investigate factors that may impact RCC pavement performance (e.g., mix design and joint spacing), evaluate the cracking mechanism and joint performance of RCC pavements over different stabilized base materials, develop performance prediction curves suitable for use during thickness design of RCC pavements, develop an M-E thickness design procedure for RCC pavements, and compare actual versus predicted performance of RCC pavements using the developed design procedure.

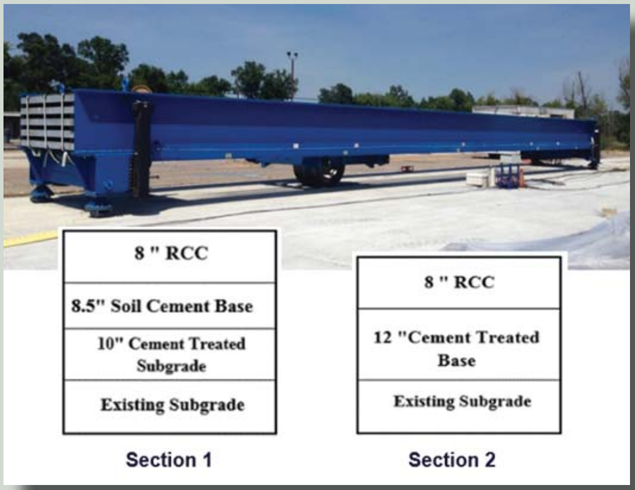


*Figure 1*
*Pavement structure of RCC test sections at PRF*

## METHODOLOGY

A comprehensive literature review of RCC pavement design/construction practices and performance evaluations will be conducted. A database containing information about historic and in-service RCC projects will be established.

Two 8-in. thick RCC pavement sections at the LTRC pavement research facility (Fig. 1) will be tested under accelerated loading: one section over an 8.5-in. soil cement base (300 psi minimum

UCS) and one section over a 12-in. cement treated soil base (150 psi minimum UCS). Accelerated loading of the sections will proceed until a failure criterion of 1 ft/ft$^2$ visible cracking exists over 40% of the trafficked area.

Forensic evaluation and laboratory tests will be used to identify material properties, crack type, and location of crack initiation. Results will enable development of an M-E RCC thickness design procedure.

A finite element simulation model will be developed to predict RCC pavement responses and verified by measured results. The key for development of M-E pavement performance models is to determine the effects of variables (e.g., slab size or thickness) on pavement responses which can be correlated with field performance (e.g., stress, strain, and deflection).

A prototype RCC thickness design module (Fig. 2) suitable for use in the Pavement ME design software (or a standalone M-E RCC thickness design procedure) will also be developed.

## IMPLEMENTATION POTENTIAL

Anticipated results include useful tools for thickness design and performance evaluation of RCC pavements using an M-E approach. A detailed design manual will be established for DOTD implementation of RCC pavement applications.

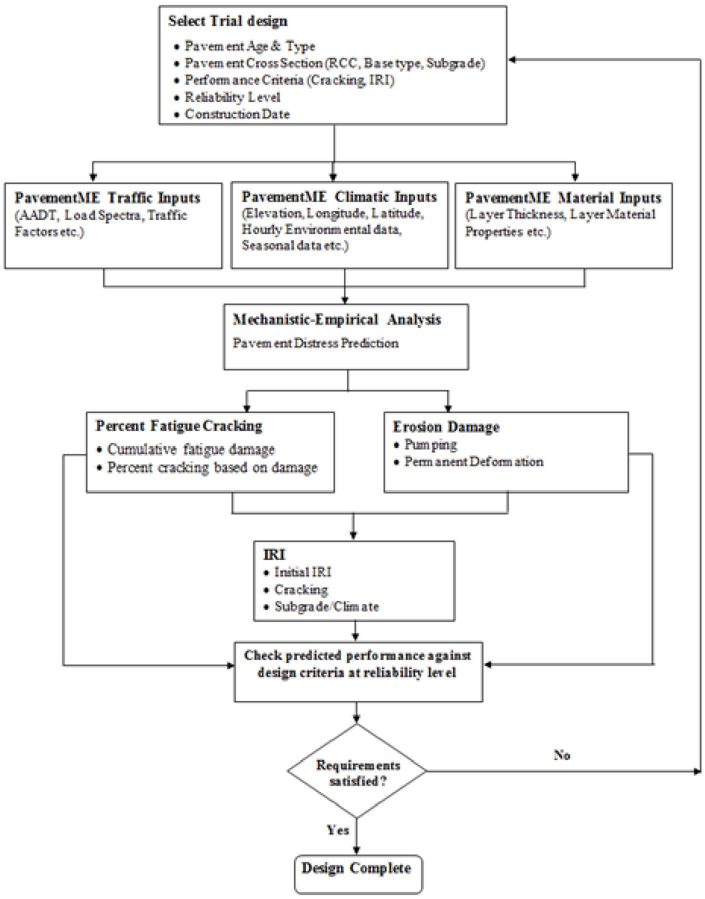


*Figure 2*
*Mechanistic-empirical design process for RCC pavements*