# Project Capsule

26-1B

July 2025

## Effect of SARA Asphalt Binder Fractionations on Laboratory Performance of Asphalt Mixtures

### PROBLEM

The Louisiana Department of Transportation and Development (DOTD) currently assesses asphalt binder quality primarily through physical and rheological properties, with limited chemical characterization using Gel Permeation Chromatography (GPC). While GPC provides information on molecular size distribution, it does not sufficiently capture the chemical characteristics that directly influence asphalt binder performance in flexible pavement applications. A more robust evaluation method involves characterizing the asphalt binder's chemical composition based on solubility in different solvents, as defined by SARA (Saturates, Aromatics, Resins, and Asphaltenes) fractionation.

To address this gap, LTRC initiated a project (22-1B) that employed Thin Layer Chromatography with Flame Ionization Detection (TLC/FID) to separate asphalt binders into their SARA fractions, providing a more detailed chemical profile of asphalt binders used in Louisiana. However, this project was limited to chemical characterization of asphalt binders alone and did not consider the interactions between the asphalt binder and other mixture components, such as aggregate type, gradation, and asphalt content, that significantly affect the mechanical performance and durability of asphalt mixtures in service. Therefore, a more holistic approach is required, one that integrates SARA-based binder characterization with laboratory mechanical performance testing of asphalt mixtures. Such an approach is essential to better understand and predict the performance of asphalt pavements in Louisiana and guide the specification and selection of asphalt binders based on both chemical and mechanical performance criteria.

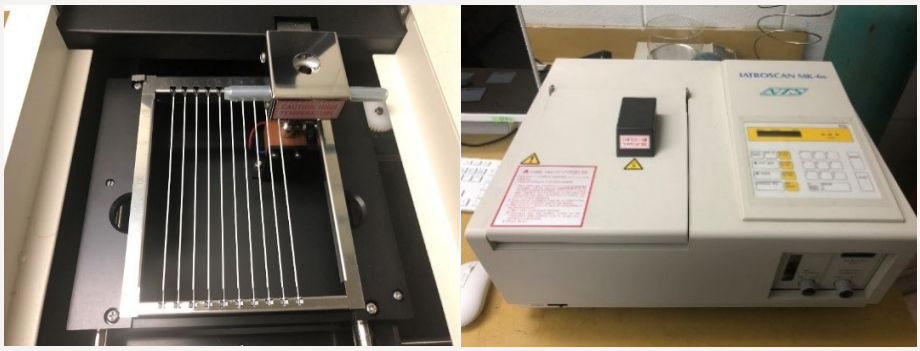

*Figure 1. SARA test setup*

**Start Date**
June 1, 2025

**Duration**
14 months

**Funding**
SPR: TT-Fed/TT-Reg - 5

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## OBJECTIVE AND SCOPE

The objective of this study is to evaluate the influence of asphalt binders possessing the same Performance Grade (PG) but differing in chemical composition as characterized by SARA fraction percentages on the mechanical performance of asphalt mixtures across high, intermediate, and low temperatures.

Two sets of laboratory experiments will be conducted: (1) asphalt binder characterization and (2) asphalt mixture performance testing. The asphalt binder characterization will include PG grading, Gel Permeation Chromatography (GPC), and SARA fractionation analysis. The asphalt mixture testing will include a comprehensive suite of laboratory mechanical performance tests: Semi-Circular Bend (SCB) and IDEAL-CT tests for fracture and fatigue resistance; Loaded Wheel Tracking (LWT) and IDEAL-RT tests for rutting resistance; SCB test for low-temperature cracking performance; and the Cantabro test for durability assessment.

## METHODOLOGY

The methodology will be structured around the seven key tasks listed below:

- Task 1 – Conduct a literature review
- Task 2 – Identify and collect asphalt binders
- Task 3 – Perform asphalt binder characterization experiment
- Task 4 – Perform asphalt mixture design
- Task 5 – Perform asphalt mixture performance experiment
- Task 6 – Perform data analysis
- Task 7 – Prepare final report

## IMPLEMENTATION POTENTIAL

The results of this research are expected to provide a deeper understanding of how variations in asphalt binder chemistry influence the durability and overall performance of asphalt mixtures in flexible pavements. By identifying key chemical composition factors that correlate with enhanced mechanical properties, findings will support the development of criteria for binder selection. It is anticipated that results from this research will guide revisions to asphalt binder specifications, ensuring that both chemical and mechanical performance factors are considered, ultimately leading to more durable and longer-lasting pavements.

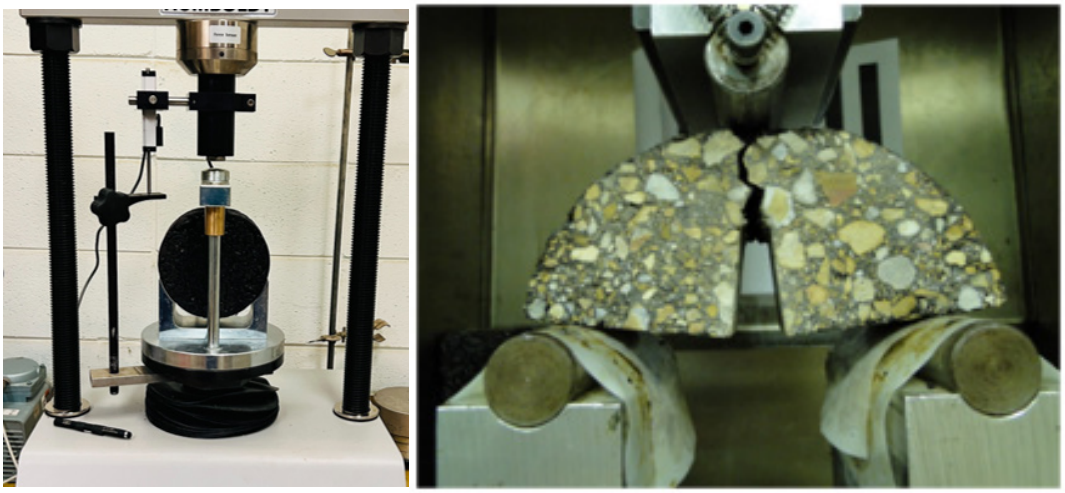

***Figure 2. Asphalt mixture testing equipment***