



## Research Summary

# Utilization of Accelerated Pavement Tester (APT) for New Materials and Pavement Structure Research



### ***WHAT WAS THE RESEARCH NEED?***

Accelerated pavement tester (APT) is a pavement loading device with full-scale wheels that can be used to provide a quick, efficient, and effective tool for research in pavements. With the ever-growing traffic volume and ever-tightening budget constraints, it is a great challenge for state highway agencies to keep the highway network operating smoothly. This research aimed to utilize the accelerated pavement testing device and pit at UTK to investigate the many

options to improve pavement performance in Tennessee by using new pavement materials, pavement structure, and pavement maintenance and rehabilitation methods. TDOT has long been trying to use the APT method to evaluate full-scale pavement structures including geosynthetic-reinforced pavement.

### **Project Number:**

RES2019-12

### **TDOT Lead Staff:**

Mark Woods  
Maintenance Operations

### **Principal Investigator:**

Baoshan Huang  
University of Tennessee,  
Knoxville

### **Project Term:**

January 2019 to May 2022

### ***WHAT WERE THE RESEARCH OBJECTIVES?***

The main objective of this study was to apply the APT method to investigate the performance of inverted pavement structures and their reinforcement methods.

### ***WHAT WAS THE RESEARCH APPROACH?***

The performance of a full-scale inverted pavement was investigated using the APT method, and a conventional flexible pavement under the same environmental and loading conditions was studied and compared in the first round of APT. In addition, the effect of geogrids on the structural performance of the inverted pavement was studied in the second round of APT in this project, which has never been conducted before. Through the full-scale

test coupled with APT, the detailed construction experience of the full-scale inverted pavement structure was provided, and the testing results can also extend the understanding of the difference in structural responses between the inverted and conventional pavement structures.

### ***WHAT WERE THE FINDINGS?***

The key findings from this research project are summarized as follows:

- APT is a highly efficient testing method to investigate the structural responses of both the inverted and conventional pavement structures under a controlled loading and environmental conditions.
- Based on the overall rutting performance, the inverted pavement structure had a comparable or better performance compared with the conventional flexible pavement structure under the same loading and environmental conditions. Thus, the inverted pavement can be regarded as an alternative to the traditional flexible pavement.
- The inverted pavement structure differed from the conventional pavement structure in the accumulating permanent surface deformation with APT's passes.
- The location of geogrids plays an important role in reinforcing aggregates in the UAB layer of the inverted pavement. In this study, geogrids placed at the upper 1/3 layer of UAB improved the rutting resistance of inverted pavement. However, geogrids installed at the 2/3 thickness of UAB resulted in worse rutting performance. Due to the stress-dependent property of UAB layer in the inverted pavement, the geogrids placed at the upper 1/3 layer could experience much higher tension and take effect to provide more constraints for the aggregates, contributing to the increase of its stiffness.

### ***IMPLEMENTATION AT TDOT***

Based on the findings, the potential recommendations are summarized as follows:

- During the construction of inverted pavement structures, the compacted UAB layer should be left for one night before placing the asphalt concrete layer to lower its moisture.
- The aggregates for the UAB layer of inverted pavement should be treated carefully. The small particles of aggregates ( $\leq 0.025$  mm) should be partially removed to strength the interlocking of aggregates during the loading.
- The geogrids can be used as reinforcement in the UAB layer and improve the rutting resistance of the inverted pavement structure but the location of geogrids is of great importance.

### ***MORE INFORMATION***

Find the final report here: [https://www.tn.gov/content/dam/tn/tdot/long-range-planning/research/final-reports/res2019-final-reports/RES2019-12\\_Final\\_Report\\_Approved.pdf](https://www.tn.gov/content/dam/tn/tdot/long-range-planning/research/final-reports/res2019-final-reports/RES2019-12_Final_Report_Approved.pdf).