



U.S. Department of Transportation  
**Federal Highway Administration**

Research, Development,  
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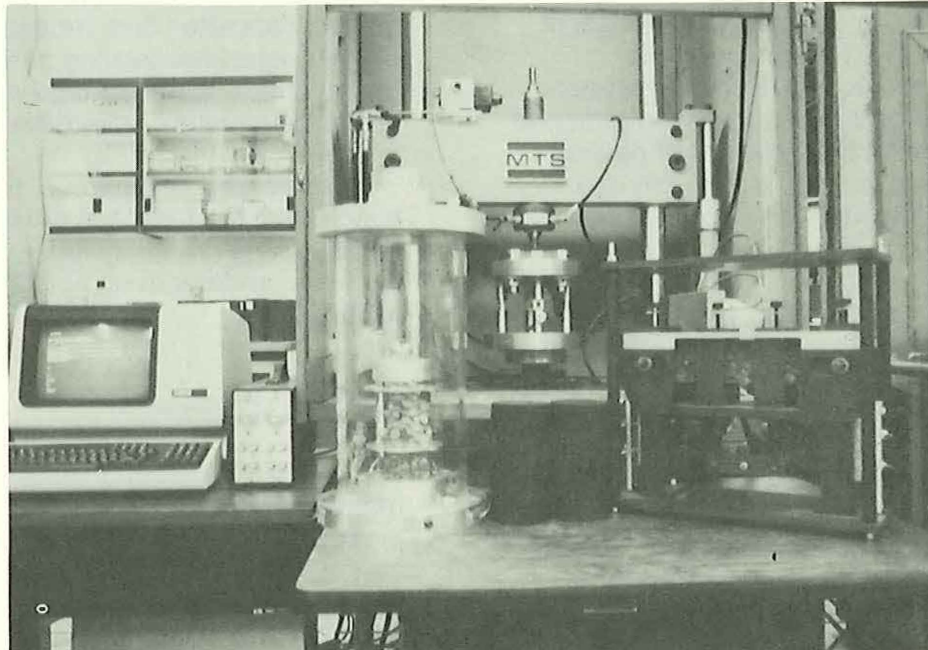
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Research Center  
6300 Georgetown Pike  
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# PAVEMENT PERFORMANCE LABORATORY

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Repeated Load Testing Equipment

## INTRODUCTION

The Pavement Performance Laboratory is located at the Federal Highway Administration's (FHWA's) Turner-Fairbank Highway Research Center in McLean, Virginia. The primary functions of this laboratory are to determine mechanical properties of pavement components for mechanistic design procedures, and to evaluate the structural response of prototype pavements.

## FEATURES

The Pavement Performance Laboratory includes facilities for conducting static and repeated load tests on pavement materials, as well as two 10-ft by 10-ft test pits for measuring the response of prototype test pavements on natural soil foundations. All tests are conducted in environmental chambers using either pneumatic systems or an MTS closed loop electro-hydraulic testing machine. The laboratory is equipped with a

full range of electronic instrumentation. A microcomputer-based data acquisition system is available for data acquisition, reduction, and storage.

## REPRESENTATIVE STUDIES

### Verification of Pavement Design Models

Since the mid 1960's, the FHWA's Office of Research, Development, and Technology has been developing and verifying a mechanistic design procedure for the structural design of flexible pavements. This procedure is implemented through the VESYS computer program, and since it is based on fundamental principles governing the behavior of paving materials, the procedure is applicable to a broad range of materials, axle loads, and environmental conditions.

Most capabilities of the Pavement Performance Laboratory were developed in conjunction with VESYS. Facilities were developed for determining mechanical properties of the pavement layer components. This includes primary response properties such as complex modulus, resilient modulus, and creep compliance, as well as distress properties, such as, permanent deformation and fatigue. In addition, two prototype flexible pavements were constructed and tested in twin 10-ft by 10-ft by 8-ft deep concrete test pits. The test pits are enclosed, and temperature can be controlled from 0 ° F to 110 ° F. Both prototype pavements have a 7-ft clay subgrade and an 8-in crushed aggregate base course. The pavements have asphalt concrete surface course thicknesses of 2.5 and 6.5 in. Static and repeated loads are applied with a hydraulic actuator acting on a water-filled rubber bag at the pavement surface. Surface deflections measured for the prototype pavements were used to verify the viscoelastic primary response model contained in VESYS.

### Mechanical Properties

The repeated load testing facilities of the Pavement Performance Laboratory have been used to obtain mechanical properties of pavement components for numerous staff and contract research studies. Specific examples include:

- o An evaluation of Sulphlex paving materials using beam on elastic foundation fatigue tests, dynamic and resilient modulus tests, and creep tests.

- o The characterization of the subgrade soil at The Pennsylvania State University Pavement Durability Research Facility using creep and repeated load tests.

- o An evaluation of the permanent deformation characteristics of a New Jersey asphalt concrete using repeated load tests. Design equations relating permanent deformation to temperature, stress level, and mix design parameters were developed.

- o The characterization of the asphalt concrete at the FHWA Pavement Testing Facility using creep, dynamic and resilient modulus, and beam on elastic foundation fatigue tests.

## FUTURE RESEARCH

The evaluation of current testing methods for determining the mechanical properties of pavement layer components will be the main focus of the laboratory in the immediate future. The laboratory will also continue to provide mechanistic material properties in support of staff and contract research studies. In addition, FHWA and State engineers may obtain information concerning the American Association of State Highway and Transportation Officials resilient modulus test for subgrade soils or with other mechanistic test procedures.

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