

Isothermal Testing for Better Road Design

Researchers who work in the **Pavement Isothermal Test System (PITS)** are currently developing mechanistic pavement design procedures. Based on fundamental material properties, these pavement design procedures will allow pavement designers to predict the performance of pavements before construction and help them select better pavement alternatives.

Asphalt Concrete (Flexible) Pavements

Theoretical equations are used to predict the critical responses in pavement systems. These theoretical response models require calibration and/or verification. Prototype pavement tests for a controlled load and environment are conducted by the PITS researchers to provide data to calibrate these theoretical response models. Recent models have dealt primarily with flexible pavements.

In order to help develop the VESYS computer analysis and design system, a prior flexible pavement response study tested two thicknesses of conventional asphalt concrete pavements with granular base courses constructed on clay subgrades. The pavements were subjected to three load levels at four temperatures. Strains, deflections, and loads were measured at various points in the pavement systems. The results have not only helped develop the VESYS, but also helped verify back calculation models.

Laboratory Materials Testing

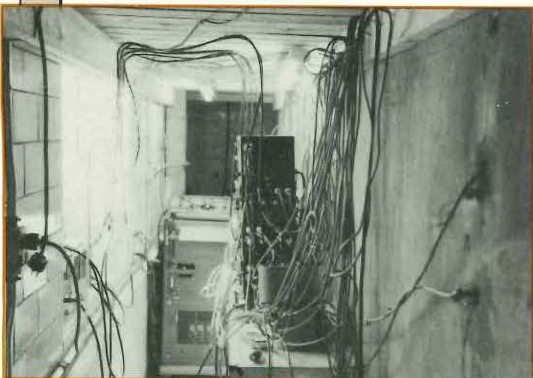
One study in which the temperature control capabilities of the PITS were used involved production testing of a proposed new material. Called Sulphlex, this material was designed

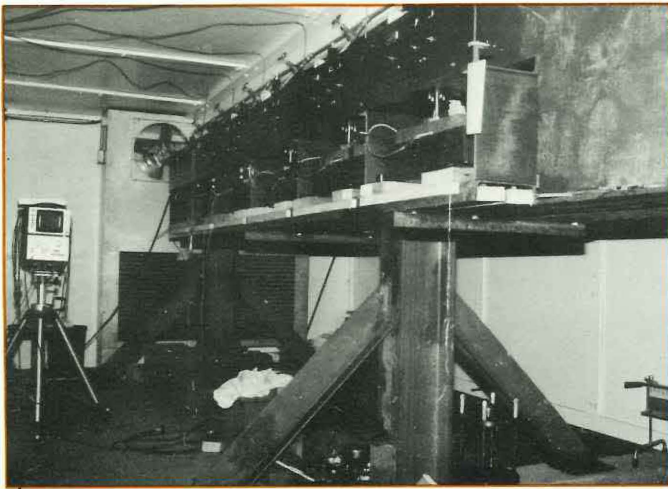
to reduce asphalt production dependence on oil. Load frames were fabricated to conduct six fatigue and six repeated load triaxial compression tests simultaneously. These tests were accelerated so that the performance of conventional asphalt concrete could be compared to Sulphlex in a timely manner.

Multiple fatigue tests were required for this project in order to develop fatigue curves at various temperatures. In order to closely simulate field conditions, the FHWA fatigue test method was adapted from the Georgia Tech "beam on rubber test method." Some of the fatigue tests required several weeks worth of millions of repeated loads to failure. This required performing multiple tests simultaneously to expedite the evaluation of the new material.

International Cooperative Study on Soil Performance

The next phase of tests in the PITS, planned for 1993, will study the subgrade soil strain design criteria. Current subgrade criteria were developed independent of soil type and conditions. Laboratory material tests indicate that for wet soils more of the dynamic strains become permanent which can cause pavement deterioration. This study will measure permanent strains, in full-scale subgrades, of various soil types and moisture contents at various load levels.





THE PAVEMENT ISOTHERMAL TEST SYSTEM

The **Pavement Isothermal Test System (PITS)** at the TFHRC was built in the late sixties as part of the old Structures Lab in the Annex Building. The PITS became operational in the early seventies after temperature control devices were added and initial trial tests on a pair of half-scale and then full-scale models were completed.

Originally, loads were applied by servo-hydraulic equipment so that the load magnitude and function could be controlled. Linear Voltage Displacement Transducer's (LVDT's) and strain gauges measured pavement response, which was recorded on magnetic tape and later converted to digital form by a computer program specially written for this study. Material tests were originally conducted on all the layer materials including clay, crushed stone, and asphalt concrete. In this fashion it was possible to exercise mechanistic computer programs, and compare predicted with measured pavement response.

Today the PITS includes two, full-scale, instrumented test pavements. Each test pavement measures 3 m by 3 m by 2.4 m deep (10 ft by 10 ft by 8 ft deep). Loads from 10,000 to 40,000 N (2000 to 9000 lbf) are applied using a servo-hydraulic system via a 300 mm (12 in) diameter water bag. The water bag is used to

better simulate how computer programs model truck wheel loads on pavement. LVDT and strain gauges continue to measure pavement response. However, today data is recorded digitally through a computer system. The PITS has a temperature control system to maintain the test temperature from -10 to 40 °C (14 to 104 °F). In the next phase of the lab's development, techniques will be studied to control subgrade moisture content during testing.

The engineers and technicians who work in the PITS have been leaders in the development of mechanistic pavement design procedures over the last 25 years. They are committed to providing State transportation agencies with proven and cost-effective pavement design methods. This dedication helps make the TFHRC a world-class highway research facility, and helps move America into the 21st century.

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Operated by the Federal Highway Administration's (FHWA) Office of the Associate Administrator for Research and Development, the Turner-Fairbank Highway Research Center (TFHRC) is the Nation's primary highway transportation research and development facility. Located in McLean, Virginia, just inside the Capital Beltway, the Center consists of a number of world-class testing and laboratory facilities. The FHWA built and operates these facilities to support the expertise of scientists, engineers, academicians, students, and others who are working on important highway research. Through the FHWA's Office of the Associate Administrator for Research and Development, their efforts help make the world's largest highway system safer and more efficient.

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