Penn State's Continuing Pavement Test Is Yielding Valuable Research Results

Research engineers at Pennsylvania State University are going places—on a road that goes nowhere.

The road, built in 1971, is a one-mile, one-lane, oval-shaped track. It was built to meet the need for an integrated pavement research program to evaluate pavement durability and bridge construction.

Construction funds for the bridge were provided by the Pennsylvania Science and Engineering Foundation. The Pennsylvania Department of Transportation and the Federal Highway Administration are sponsoring the research.

"The whole idea," explains Dr. Robert M. Barnoff, professor of civil engineering, "is to advance knowledge in the transportation field, particularly highway transportation. This project also provides the university with a continuing research project, which we hope will be in operation for many years to come."

Owned by the university, the Pavement Durability Test Facility's highway now is being tested to determine the best base-course material for standard Pennsylvania highway pavement design. There are 17 different base-course sections, with each section containing a material type or material thickness variable. The pavement surface is a uniform ID-2A wearing course.

"We're trying to get the best pavement for the least cost," explains Dr. Barnoff.

Traffic on the track is provided by a conventional truck tractor with a semi- and a full-trailer which is in operation 18 hours a day, seven days a week. By the beginning of August 1973 the vehicle had gone 120,000 miles and had worn out 50 tires. The eight drivers, who work in pairs and alternate hourly, start at 6 a.m. and drive until 11 p.m. The loading on the trailers is changed periodically to give a mixed load spectrum.

At the project's completion, the truck will have circled the track 200,000 times.

Boxes containing recording equipment are set up along the track and measure the soil pressure and stress on the soil and the pavement. A weather station records rainfall and temperature change and correlates the weather with the deterioration of the pavement. To date, only minor damage has been done to the highway, indicating normal wear.

A separate skid test area is provided on the inside shoulder of the cut tangent. This area, 1,000 feet long and 15 feet wide, contains ten test surfaces for skid-resistance studies. There are also both cut and fill areas and the School of Forest Resources is doing research on the effects of diesel fumes on trees.

Also included in the track is a 120-foot, two-span standard highway bridge, comparable to a bridge built over an Interstate highway or small stream. It is constructed with prestressed concrete beams. The objective of the bridge research is to compare two types of bridge deck construction and evaluate the behavior of each.

The materials for the deck construction are basically the same, but the arrangement is different. Both spans of the bridge are identical except for the deck slabs.

The deck slab in the first span was constructed by using conventional techniques. Half of the span was made with wood forms and the other half with metal stay-in-place forms. Both of these methods are used extensively in Pennsylvania bridges.

The second span of the bridge was constructed with prestressed concrete planks covered with $4\frac{1}{2}$ inches of concrete. This method shows promise of economical construction costs. Although this method has been used to a limited extent in other areas, it has not been tried on any Pennsylvania highway bridges.

To compare the different deck constructions, the bridge has been instrumented with strain gauges and deflectometers. These instruments are used to determine wheel load distributions, deflections, and stresses at many locations in the bridge.

One of the major problems is that bridge decks deteriorate and crack quite rapidly. Repair is not only expensive but is also inconvenient. Deterioration begins when the deck cracks slightly, allowing the penetration of moisture that causes the reinforcing steel to corrode and the concrete to crack even further. Deterioration is being monitored on the experimental bridge, and different deicing agents are applied during inclement weather to compare their effects on the rate of deterioration.

To date, only minor differences have been observed between the two different bridge constructions. The real test will come next spring when a four-wheel vehicle with 80,000 pounds on each wheel will be used.

The first cycle of research at the facility will continue through June 1974. At that time a new set of pavements and a new bridge will be installed for the second cycle.

"Weight will be applied until the bridge is no longer serviceable," commented Dr. Barnoff. "Then the bridge will be replaced and there will be more pavement tests—possibly more bridge tests with a different kind of bridge."

REPLACEMENT OF CUTBACKS WITH EMULSIFIED ASPHALT

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Engineers have long recognized that dissolving asphalt in gasoline and kerosene to produce RC and MC liquid asphalts results in a compromise product. Road performance is sacrificed for ease of handling. A low priority is placed on air pollution and fire requirements. The entire cutback system is viable only when there is an excess of energy fuels at low cost. The public concern for pollution, road and road maintenance costs, ecological imbalances, and resource depletion already has led to regulation, additional costs, and constraints to highway construction. Clearly, the programs for cutback replacement, started over 20 years ago, must be accelerated.

The need for improved road performance in urban and high-volume roads led to the replacement of cutbacks with asphalt cement in surface-mix construction. Emulsified asphalts replaced, in large measure, the use of cutbacks in maintenance surface treatments. As a result, the percentage of cutbacks used in road construction dropped from about 35 percent in 1952 to less than 20 percent in 1972.

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