



Prestressed, precast panel being lowered onto roadbed at South Dakota test site

## South Dakota Studies Use of Prefabricated Highways

**SOUTH DAKOTA** State University, with the help and encouragement of the South Dakota Department of Highways and the Bureau of Public Roads, has developed what it says is the first prefabricated highway in existence. Emil R. Hargett, associated professor of civil engineering at the university, explains that "prestressed and precast portland-cement-concrete have never before been linked together and used in highway construction."

Mr. Hargett has developed a prestressed, precast concrete panel that can be lowered on a roadbed by a crane. The panels are 6 ft. wide, 24 ft. long and 4½ in. thick. Each reinforced panel weighs 4 tons and contains 2 cu. yd. of concrete. Panels are shipped from their construction location by truck and are put in place with the use of a large crane. Four loops are precast in the panels for easy handling and are removed after the panels are in place.

"The increase in traffic, particularly heavy truck traffic, has cre-

ated a need for a stronger but more flexible pavement," Mr. Hargett says. "It must withstand heavy wheel loading without maintenance problems that are common to many pavements subjected to large traffic volumes." The panels can be used for emergency repairs on highways and for spot construction at busy intersections.

Prestressed concrete has been used in recent construction of airport runways and for limited sections of highways. Rigid pavement of this type eliminates most of the expansion joints required in more conventional types of rigid pavement. Tension held by an embedded cable can help eliminate cracks from stress and weather.

Working together with the South Dakota Department of Highways to coordinate his research with practical application, Mr. Hargett plans to combine present-day highway construction with a type of off-site precasting, thereby reducing the expense involved at present with prestressed rigid pavement.

The program is divided into three parts: (1) investigation, (2) installation of slabs, and (3) field study of performance with cost of a short length of composite pavement.

Installed sections consist of prestressed and precast concrete panels that are interconnected and covered with a 1½-in.-thick asphalt mat. One installation is a 24x96-ft. section off the present state highway system. The study will also include 900 ft. of roadbed installation on the state highway system.

A. W. Potter, director of the material and tests division of the department of highways, says, "If this type of construction proves successful, it could eliminate some of the maintenance problems we'll be faced with when the interstate system is complete. Small segments of the concrete pavement could be removed to correct subgrade problems and replaced by using this method of prefabrication."

The Bureau of Public Roads is sharing the cost of this small-scale field study. ■



Above, experimental gravity type of road-impulse generator hooked up with recording equipment on two-lane secondary road. At right is close-up of operating area of impulse generator



## NCHRP REPORT

# Developing a Flexible-Pavement Test

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**THE DESIGN** and construction of highways during the relatively short history of roadbuilding must be considered more of an art than a science. The rapid development of highway transportation in the past 50 years has placed a strain on highway-department engineering staffs. Improvement in the art of roadbuilding has been based largely on the performance of past efforts. Testing of materials, components and sections of roads is used to predict performance of future designs and construction procedures.

As a project of the National Cooperative Highway Research Program, Cornell Aeronautical Laboratory, Buffalo, N. Y., has completed a study directed at finding a rapid, simple, nondestructive and accurate means of detecting changes in the load-carrying capacity of flexible pavements. The impulsive-loading technique, it reports, shows promise of meeting the stated objectives.

The report of this project, reviewed below, can be obtained

from the Highway Research Board, 2101 Constitution Ave., Washington, D. C. 20418.

**Report 21. Project 1-5.** "Detecting Variations in Load-Carrying Capacity of Flexible Pavements" (\$1.40).

Seasonal load restrictions must be placed on thousands of miles of flexible pavements to prevent serious damage during spring thaws, when bearing capacity of subgrade soils is reduced. The time for application of these restrictions, reduction in axle or wheel loading and duration of the restrictions are usually based on engineering judgment. Plate-bearing, moving-deflection, vibration, sonic, density and moisture tests have been used to help in making these judgments, but a need still exists for an accurate method of measuring relative load-carrying capacity.

An impulsive-loading device, previously developed by Cornell Aeronautical Laboratory, offered promise of providing simple, rapid and nondestructive testing of flexible pavement sections. This study was made to determine the feasibility of such a technique.

The device used consists of a mechanism by which a steel bar of known weight is dropped, strikes a base plate on the road surface and is caught on the first bounce. Measurements are made of the vertical dynamic displacement of the pavement, rebound time of the bar, duration of contact between the bar and the striker plate (impulse duration) and wave-propagation time. The study included three parts: (1) investigation of the technique by analytical methods; (2) construction of an experimental impulse generator and the necessary instrumentation, and (3) performance of field tests to evaluate the effectiveness of the method. The development of a practical field-operational testing device was not included in this project.

*Analytical studies.* In a search of literature during analytical investigation of the technique, no solutions or formulas were found that give the response of a flexible pavement to impulsive loads.

The maximum dynamic displacement resulting from impulsive loading will depend not only on the