LTRC RESEARCH PROJECT CAPSULE

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TECHNOLOGY TRANSFER PROGRAM

JUST THE FACTS

Monitoring Bridge Scour Using Fiber Optic Sensors

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30 months

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FHWA—IBRD

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PROBLEM

The interstate highway network is an important national asset. Bridges constituting critical nodes within transportation networks are the backbone of the transportation infrastructure. It is well known that scour is one of the major courses of bridge failures. In the last 30 years, more than 1,000 bridges collapsed in the United States, and about 60 percent failures are related to the scour of bridges' foundations. Due to the difficulty in inspecting bridge scour, scour-induced failures tend to occur suddenly without prior warning or signs of distress to the structures. With the threat of hurricane-induced flooding and the fact that there is a significant number of coastal and river/bayou bridges in Louisiana, a more reliable inspection and monitoring procedure for bridge scour is needed.

In cooperation with state DOTs and the Transportation Research Board, The Federal Highway Administration (FHWA) has developed some scour monitoring and inspection instruments. However, there is a need to develop more reliable, economical instrumentation and equipment to measure bridge scour for the purpose of research and to indicate when a bridge is in danger of scour failure.

OBJECTIVE

The objective of this study is to develop a scour monitoring system for bridge piers. The system may be used for existing or newly constructed bridges. The existing equations and methods for bridge scour predictions are based primarily on laboratory research and have not adequately been verified with field data. The developed system will collect field data that can be used to

SPECIAL POINTS OF INTEREST:

- Problem Addressed
- Objectives of Research
- Methodology Used
- Implementation Potential

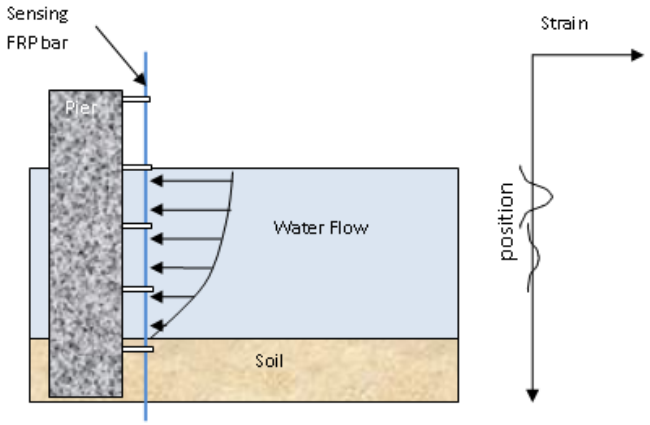

Figure 1
Concept of scour monitoring

verify the applicability and accuracy of the various design procedures for the range of soil conditions, stream flow conditions, and bridge designs in Louisiana and eventually result in improving existing scour prediction methods.

METHODOLOGY

Real-time monitoring of bridge scour is classified into two basic types of equipment: (1) a fixed one that is permanently installed on a bridge, such as falling rods, sliding collars, sonar, conductance probes, etc. (2) and a portable one that is used by field personnel to make measurements at any bridge. The highway department usually needs only the elevation of the streambed to evaluate the stability of the bridge foundations. However, when the streambed elevation measurements are combined with hydraulic measurements, such as flow velocity, the data becomes valuable for bridge-scour prediction and research. Such information can also provide valuable data on the initiation and rate of scour as well as under what conditions scour holes refill. Likewise, mobile field teams making measurements at selected bridges can supplement the streambed elevation measurement with a discharge measurement and other hydraulic observations to complete a limited-detailed data set. The present study will focus on developing a fixed instrumentation for the monitoring of streambed elevation, supplemented by the instrumentation of other hydraulic parameters.

The scouring process excavates and carries away material from the bed and banks of streams and from around the piers and abutments of bridges. Scour undermines bridges and may cause bridge failures due to structural instability. Scour is a complicated process and the factors affecting bridge scour include channel and bridge geometry, floodplain characteristics, flow hydraulics, bed materials, channel protection measure, channel stability, riprap placement, ice formations, debris, etc.

IMPLEMENTATION

A scour-monitoring system, using fiber optic sensors, will be developed. The long-term performance of the bridge will then be monitored during their service life. Taking advantage of the new development in fiber optic sensors, this demonstration project will potentially provide a new monitoring method to enhance the transportation infrastructure in Louisiana.

The project is intended to be a direct implementation of research results by using fiber optic sensors to monitor bridge scour in Louisiana, which will develop needed expertise and application procedures. Dissemination of the research results will help the future implementation of bridge scour monitoring techniques, and feedback from practical engineers will help judge the progress of implementation.

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