U.S. Department of Transportation
Federal Highway Administration

Priority, Market-Ready Technologies and Innovations

Ground-Penetrating Radar

Problem: Highway pavement assessment generates significant maintenance costs

A significant portion of the cost of maintaining the highway system goes to determining the remaining service life of pavements and highway structures such as bridge decks. One of the greatest challenges in rehabilitating pavements is determining what is causing them to deteriorate and selecting the most appropriate rehabilitation measures.

How are pavements tested?
Traditionally, highway engineers have used such techniques as drilling core samples out of the pavement to establish layer thickness and determine what conditions beneath the road surface are causing it to deteriorate.

What are the disadvantages?
Conventional processes for taking core samples are labor intensive, require lane closures, and create potential safety hazards for highway workers and the traveling public. Extracting pavement cores and analyzing them at an offsite laboratory can be time consuming and expensive.

Solution: Ground-Penetrating Radar surveys pavements quickly and inexpensively

Using ground-penetrating radar (GPR) technology, highway engineers can assess subsurface conditions at a fraction of the cost of conventional methods. GPR systems survey pavements quickly and with minimal traffic disruption and safety risks.

What is GPR?
GPR technology is a field survey method that creates a cross-sectional image of the pavement subsurface. It is a pulse-echo technique for measuring pavement layer thickness and other properties, such as moisture content.

In a GPR system, antennas mounted on a moving vehicle transmit short pulses of radio wave energy into the pavement. As this energy travels through the pavement structure, echoes are created at boundaries of dissimilar materials, such as at an asphalt-base interface. The strength of these echoes and the time it takes them to travel through the pavement can be used to calculate pavement layer thickness and other properties.

Why use GPR?
GPR surveys can be conducted anywhere. The survey equipment is mounted on a vehicle that can travel at normal highway speeds, so lane closures are not required, traffic is not interrupted, and highway workers are not exposed to safety hazards. The equipment is compact and easily transportable.

GPR has a variety of applications, including assessing freeze-thaw damage, evaluating deterioration, measuring overlay thickness, and maintaining quality control of steel reinforcing bar placement.

Successful Applications: States use GPR to survey pavements and bridge decks

The Strategic Highway Research Program, Federal Highway Administration (FHWA), and several State departments of transportation (DOT) have conducted studies demonstrating the advantages of using GPR technology. Several States-including Florida, Louisiana, Michigan, North Carolina, and Texas-use GPR in their pavement evaluation programs.

The Florida DOT acquired a GPR system to gather data on pavement layer thickness and base layer material properties for its pavement management inventory. The system can collect data at a rate of more than 322 kilometers (200 miles) per day.

The Arizona DOT used GPR to survey 135 bridge decks as part of a bridge inspection program. The project provided data on deck conditions and steel reinforcing bar depths on more than 0.139 million square meters (1.5 million square feet) of bridge deck. Results were available quickly and at an affordable cost. GPR allowed the State to test as many as 12 bridges a day without lane closures, traffic disruptions, or exposure of highway workers to safety hazards.

Benefits

- Rapid, nondestructive, cost-effective survey method.
- Real-time data collection.
- Numerous areas of application.

Additional Resources

More information on GPR, including a presentation on implementing a GPR program, is available at **www.aashtotig.org/focus_technologies/gpr/**.

For more information, contact:

Mike Murphy, Texas DOT
E-mail: mmurphy@dot.state.tx.us

FHWA-HRT-04-072
HRTS-03/01-04(1M)E