Nenad Gucunski/ CAIT

This monthly report from the University Transportation Centers Program high–lights some of the recent accomplishments and products from one of the University Transportation Centers (UTCs). The UTC Program is administered by the U.S. Department of Transportation's Research and Innovative Technology Administration.

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Getting to the Bottom of New Jersey Roads Using Nondestructive Evaluation

The value of a Pavement Management System (PMS) and the planning and cost-benefit tools it provides for decision making have long been recognized by those responsible for maintaining roadways. But to maximize the potential of a PMS, data revealing the history and condition of each mile of road is needed.

Dennis Connors

Rutgers' CAIT uses a suite of nondestructive evaluation methods and tools to assess the condition and structural properties of roads and bridge decks. Shown here is a 3D ground penetrating radar unit that can scan a lane-width in one pass.

Consider this scenario: as a DOT pavement and maintenance engineer, you are faced with budgeting the maintenance and rehabilitation of thousands of miles of roadway. In a state like New Jersey, where the network has evolved over more than 200 years, how will you know what is going to be found when digging starts? In many cases, records on a particular stretch of road are incomplete. There may be as-built drawings and specs on some sections of the network, but not a complete history of work that has been done since initial construction. In other cases, there are no records at all. So, what do you do? In the past you would proceed based on experience and available knowledge. Hopefully, both the treatment method and the money allocated for a specific job would be on target.

But the New Jersey Department of Transportation (NJDOT) found this procedure lacking. NJDOT wanted to move away from the "worst first" maintenance model and consistently implement a philosophy they call "the right fix, at the right time, for the right cost." The first step was to get an accurate inventory of around 5,000 miles of NJDOT-maintained roads, capturing quantitative data on materials, design, and condition.

Facing this monumental task, NJDOT turned to the Rutgers' Center for Advanced Infrastructure and Transportation (CAIT) for help. Teams from CAIT's Pavement Resource Program and Infrastructure Condition Monitoring Program came up with a plan to scan and record data for the entire roadway network using Nondestructive Evaluation (NDE).

NJDOT is responsible for about 7 percent of the roads in New Jersey, but this relatively small portion of the network carries 60 percent of the state's traffic. Before the job was over, the CAIT team had surveyed and gathered data on more than 4,600 lane-miles in New Jersey.

On choosing CAIT to help them, the head of NJDOT Pavement and Drainage Management, Susan Gresavage, said, "CAIT's expertise in pavement technology, and particularly NDE using ground-penetrating radar, offered NJDOT a very cost-effective way to enhance our pavement structural inventory data. Ultimately, this will improve the accuracy and effectiveness of our pavement management system."
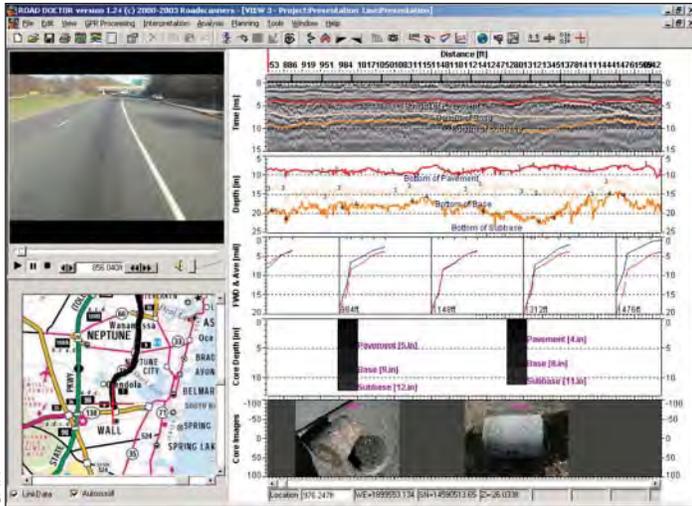
CAIT

The NDE team from Rutgers' CAIT uses a variety of tools to assess road condition and structural properties. Using Road Doctor, engineers can assess video of the road surface, GIS location on a map, reference photos, and radar data all at once.

Why NDE?

Nondestructive Evaluation encompasses several techniques and tools that are used to collect and analyze the structural makeup and condition of pavement and other infrastructure. NDE tools quantitatively measure and assess the characteristics, quality, or sufficiency of materials and structures by probing mechanical, electrical, thermal, optical, or other physical or chemical properties. Some of these technologies include ground-penetrating radar; infrared thermography; and seismic, electromagnetic, and ultrasonic methods.

Just as a doctor uses X-rays or MRIs to detect broken bones or tumors, infrastructure professionals use NDE to see what is below the road surface. NDE is essential for collecting accurate condition and structural data for use in PMSs and other asset-management systems. NDE also can spot potential issues before they are visible on the surface, so preventative measures can be taken before small problems become big ones.

Unlike "dig and delve" testing, NDE leaves the structure intact, and in most cases it is less costly, less disruptive, faster, and more accurate than traditional infrastructure testing methods such as coring, chain drag, hammer sounding, chloride content, or even half-cell potential measurements. And, because NDE doesn't require extended lane closures, it can alleviate inconvenience to drivers as well.

Next Steps

NDE data collected by CAIT, along with other data on ride quality and surface distress, will provide NJDOT decision-makers with the information they need to plan and make decisions that reap the best value for the State's road-repair dollar. ICMP Director, Dr. Nenad Gucunski, noted, "A small investment today could avert a bigger bill tomorrow. Just as in health care, prevention and early detection is ultimately far more cost effective than late-stage intervention."

Now that the first phase of the survey is done, CAIT is supporting NJDOT with field data analysis and entry into the agency's current PMS. In the future, CAIT will assist NJDOT in developing an enhanced PMS that will analyze condition data, determine network sections in need of repair, and recommend the most appropriate treatment at the least cost.

What's the bottom line? NJDOT's approach of "the right fix, at the right time, for the right cost" means better roads for New Jersey drivers and taxpayers.