



NONDESTRUCTIVE EVALUATION LABORATORY FACT SHEET

Research that is Essential, Indispensable, and Connected to our Customers.

PURPOSE

Researchers at the Federal Highway Administration's Nondestructive Evaluation (NDE) Laboratory, located at the Turner-Fairbank Highway Research Center, develop and test NDE technologies to assess the condition of highway bridges. This assessment includes evaluating current technologies and developing new tools that will advance the practice of bridge inspection.

DESCRIPTION

The NDE Laboratory is staffed with a multidisciplinary team of experts working on tools and techniques to assess the condition of in-service highway bridges. The laboratory is the only facility in the world dedicated to advancing NDE technologies for highway bridges, and laboratory researchers work closely with State departments of transportation (DOT) across the Nation to identify and solve difficult inspection challenges.

Areas of research at the laboratory include ultrasonic testing methods, radiographic and nuclear NDE techniques, wireless instrumentation, laser measurement devices, infrared technologies, ground penetrating radar (GPR) systems, and electromagnetic NDE techniques. Researchers also evaluate the reliability and capability of NDE techniques; this includes

studying the visual inspection technique and the effects of human factors on reliability.

MAJOR COMPONENTS

A 465-square meter (5,000-square foot) laboratory equipped with state-of-the-art NDE instruments helps researchers develop and test NDE tools. Seven test bridges located in Virginia and Pennsylvania provide field test sites for NDE technologies. This site includes two bridges permanently equipped with instrumentation for monitoring bridge conditions and testing new sensors.

NDE Laboratory Capabilities:

- Visual inspection study test area.
- Ultrasonic immersion tank.
- Automated Ultrasonic Testing System.
- X-ray Computed Tomography (CT) Laboratory.
- Bridge component specimens with known defects.
- Structural test area with a 12.2-m x 3.7-m (40-ft x 12-ft) strong floor and hydraulic distribution system.
- Data acquisition systems for both laboratory and field testing.
- MTS load frame.

Outdoor Facilities at the Turner-Fairbank Highway Research Center:

- Bridge deck test pit for evaluating vehicle-mounted deck inspection methods.
- A 21-m (70-ft) prestressed box girder for evaluating NDE technologies.

Offsite Test Bridges:

- Two fully instrumented bridges open to traffic.
- Five decommissioned highway bridges to test and evaluate NDE technologies under controlled field conditions.

Primary Instrumentation Equipment:

- Laser system for monitoring structural object deformations during testing.
- GPR system for bridge deck inspections.
- Ultrasonic tank scanning system.
- X-ray CT system.
- Wireless data acquisition systems.
- Dual-band thermographic system for bridge deck inspections.
- Fatigue crack detection instrumentation.
- Ultrasonic absolute stress measurement system.
- Vehicles equipped with instrumentation necessary for field testing.

The Turner-Fairbank Highway Research Center (TFHRC) has more than 24 laboratories for research in the following areas: safety; operations, including intelligent transportation systems; materials technology; pavements; structures; and human-centered systems. The expertise of TFHRC

scientists and engineers covers more than 20 transportation-related disciplines. These laboratories are a vital resource for advancing this body of knowledge developed and nurtured by our researchers. The Federal Highway Administration's Office of Research, Development, and Technology

operates and manages TFHRC to conduct innovative research to provide solutions to transportation problems both nationwide and internationally. TFHRC is located in McLean, VA. Information on TFHRC is available on the Web at www.tfhrc.gov.

SPECIAL CAPABILITIES

The NDE Laboratory is dedicated to developing NDE technologies for highway infrastructure, and the laboratory includes a number of unique, state-of-the-art measurement technologies for nondestructive testing. For example, the x-ray CT system images the internal features of concrete, steel, and asphalt samples to provide insight into deterioration processes and internal defects. The laboratory's infrared cameras can measure stress concentrations at bridge connection details and discover defects in composite materials. The laboratory also develops dedicated instrumentation systems for health monitoring and global bridge evaluation.

ACCOMPLISHMENTS

Working with State DOTs, the NDE Laboratory has developed many methods and tools to assess the condition of highway bridges. This includes methods to detect fatigue cracks and image defects in concrete, as well as unique instrumentation for load rating of structures.

The NDE Laboratory recently completed a study to determine the reliability of visual inspection to assess the condition of highway bridges. The laboratory also has developed instrumentation for quality assurance testing of asphalt pavements, wireless bridge measure-

ment systems, and sensors for assessing the condition of bridges.

Current Activities

The NDE Laboratory's four main areas of research are:

- Nuclear technologies: Exploring the infrastructure application of radiography, neutron backscatter methods, and CT.
- Bridge deck evaluation: Testing and developing technologies such as infrared thermography and GPR.
- Global health monitoring: Exploring global bridge deflections, wireless instrumentation, and new stress measurement technologies.
- Application of commercial technology: Testing available technologies for fabrication inspection of steel girders, void detection in post-tensioning ducts, and crack detection.

EXPERTISE

The NDE Laboratory's multidisciplinary team includes researchers with expertise in mechanical engineering, materials science, electrical engineering, nuclear engineering, and civil engineering. The staff's areas of expertise include lasers and optics, ultrasonics, radiogra-

phy, infrared thermography, electromagnetic crack detection, microwaves, GPR, wireless telemetry, bridge instrumentation, and the reliability of NDE techniques.

LAB PARTNERS

The NDE Laboratory has partnerships and cooperative agreements with State DOTs, other Federal Highway Administration offices, and Federal agencies. One notable partnership is an agreement with the New York State DOT, in which the NDE Laboratory conducted full-scale testing of prestressed box beams to evaluate the applicability of composite materials for structural repair. Through this project, NDE technologies also are being developed to evaluate the load-carrying capacity of in-service structures and the condition of composite overlays.

Another important partnership is a pooled fund study to develop the next generation of GPR systems. Working with 19 participating States, the study developed a prototype ultra-wideband radar system designed to detect and image defects in concrete bridge decks. The NDE Laboratory has partnered with other State DOTs to field test and demonstrate NDE technologies for a variety of applications. All 50 States have participated in laboratory activities since it opened in 1998.

