NDEVC News

NONDESTRUCTIVE EVALUATION VALIDATION CENTER

U.S. DEPARTMENT OF TRANSPORTATION FEDERAL HIGHWAY ADMINISTRATION

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Laser System Utilized For Bridge Load Rating

The NDEVC recently assisted the Maryland State Highway Administration (SHA) in the load rating of one of their bridges. A steel superstructure, multi-girder highway bridge located on a major interstate outside Baltimore was tested in cooperation with the SHA. This bridge had experienced impact damage due to an overheight vehicle. Given the location of the bridge and the possible repair costs, the SHA felt that a load test was necessary to carefully examine the extent of the damage before any repair procedures were implemented.

NDEVC laser scanner collecting measurements during the load test.

Given the high traffic at the bridge site, using conventional instrumentation to load rate the structure would have been disruptive to the public. In an effort to address this type of situation, the NDEVC has been developing instrumentation to more efficiently load rate bridges with minimal access to a bridge and minimal effect on traffic. To achieve this goal a laser-based measurement instrument is used to remotely measure girder deflections under known static loads. No targets or surface preparations of the girder are necessary and the system can be used on both steel and concrete structures.

During the SHA bridge test, the traffic pattern under the structure was not altered. From the shoulder of the roadway under the bridge the laser system measured deflections at 45 different locations along the length of three 25-m long girders. Traffic on the structure was only briefly disrupted for placement of a load vehicle. The load test was completed in about 2 hours, which included instrument setup and the collection of seven data sets under various load configurations. Data from the test were provided to the SHA for their use in load rating the bridge.

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HERMES II Pooled-Funds Project Initiated

As a result of the January 25-27, 2000 State pooled-funds meeting that reviewed the progress of the HERMES bridge inspector project, a HERMES II pooled-funds project is being initiated by 20 States. The project will continue the development of high-resolution synthetic aperture radar (SAR) technology that can produce tomographic images of subsurface bridge deck features. The FHWA will act as lead agency for the pooled funds project. Lawrence Livermore National Laboratory (LLNL) has been tasked with modifying their original HERMES radar design to create an improved HERMES II system that can detect subsurface delaminations in bridge decks with high confidence and accuracy. The NDEVC has been tasked with validating the performance of the HERMES II radars once delivered by LLNL. The NDEVC will also provide support to LLNL when expertise gained

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NDEVC NEWS is the newsletter of the Federal Highway Administration's Nondestructive Evaluation Validation Center.

The NDE Validation Center was established by the Federal Highway Administration in 1998. The objective of the NDEVC is to improve the state of the practice for highway bridge inspection. The Center is designed to act as a resource for State transportation agencies, industry, and academia concerned with the development and testing of innovative NDE technologies. The NDEVC provides State highway agencies with independent evaluation and validation of NDE technologies, develops new NDE technologies, and provides technical assistance to States exploring the use of these advanced technologies.

The NDE Validation Center utilizes a series of unique resources to evaluate and assess the factors affecting the reliability and performance of NDE systems. The Validation Center is located at the Turner-Fairbank Highway Research Center in McLean, Virginia. To supplement the capabilities of these laboratory facilities, a series of bridges located in Northern Virginia and southern Pennsylvania are utilized to conduct field investigations. In addition, a collection of component test specimens are used in various test programs.

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Recent Happenings

NDT Engineering

A seismic device developed by NDT Engineering, Inc. of Shrewsbury, Massachusetts was recently tested at the NDEVC. The device is designed to detect deterioration of concrete in bridge decks and other locations.

NDT Engineering utilized the NDEVC's concrete deck slab components specimens for development and testing of their device. The component specimens are samples containing known and quantified types of deterioration.

Further information regarding the services performed by NDT Engineering, Inc. can be obtained by contacting Paul Fisk at (508) 845-1950.

SMT Conference 2000

The third biennial Structural Materials Technology (SMT) Conference was held February 28 through March 3, 2000 in Atlantic City, New Jersey. Sponsorship of the conference was provided jointly through the States of New Jersey and New York, and through the FHWA. This conference provides a forum for engineers and researchers to exchange ideas on the use of NDE technologies, particularly as they are applied to transportation structures. Chaired by Sreenivas Alampalli, New York State DOT, the conference attracted over 250 participants and featured 62 papers and presentations.

Presentation topics ranged from the use of visual inspection and visual enhancements to the use of ground penetrating radar and the broad topic of bridge health monitoring. Papers presented focused on emerging technologies and the application of currently available NDE techniques.

Unknown Foundation Test

The FHWA is sponsoring a research project aimed at determining the foundation classification of bridges with unknown foundations. This work is being conducted by Infrasense, Inc. of Arlington, Massachusetts.

The test method is based on the fact that piers founded on spread footings and piers founded on piles will have significantly different stiffnesses and behaviors. A field trial was recently completed at the NDEVC's Van Buren Road Bridge. The testing involved use of several different instruments to quantify the motion of the pier under known loads. Rotations, strains, and overall structural movements were measured with a series of tiltmeters, strain gages, and an LVDT mounted on the structure. The results of this trial are promising, and testing will continue on various configurations of bridges and instruments.

Cyrax 2400

The Cyrax 2400 laser scanner system was recently demonstrated at the NDEVC by Spatial Integrated Systems, Inc. This laser scanner is a digital capture tool that could be used for rapid 3D modeling of bridges or for monitoring of bridge deformations and displacements. The system was used to scan two structures, including a box girder test bridge and a diaphragm bracing structure of a curved girder bridge. For further information, contact Ali Rezaizadeh at (202) 493-3119.

Laser System Could Streamline Steel Fabrication

Shop assembly of fabricated steel bridge members is currently required by most States. This assembly comes at the expenditure of great amounts of manpower and shop space by the fabricator. The NDEVC is currently attempting to address this issue through the application of existing technologies to the fabrication industry.

The driving factor for the majority of States requiring shop assembly is the assurance that bolted splices in the steel girder will assemble correctly in the field. Current practice has many fabricators sub-drilling splice holes, assembling lines of girders, then reaming the girder and splice plate holes to fit. This process could be eliminated and full size holes could be drilled initially if fabricators had some assurance that the splice plate and girder holes would align correctly.

The NDEVC is exploring the possibility of remotely measuring splice plate holes in sections of girders and performing virtual assembly with computer software packages. Highly accurate measurement of girder and splice plate hole locations could ensure proper fit without the need for any shop assembly.
Recently, the NDEVC performed a proof-of-concept test with High Steel Structures, Inc. at a fabrication plant in Lancaster, Pennsylvania. A laser-based measurement system was used to remotely determine splice plate hole locations in a girder in the shop assembly yard. This field trial showed that the concept of remote measurement and virtual assembly is plausible and may, in the future, eliminate the need for shop assembly.

Laser system scanning a fabricated girder.

Further information on this project can be obtained by contacting Glenn Washer at (202) 493-3082 or Paul Fuchs at (202) 493-3095.

Sign Structure, Automated UT Work Starting

The NDEVC has begun work focusing on two new topics. First, inspection of light poles and highway sign structures has come to the forefront as an area of interest for many State DOTs. This is largely due to a number of recent failures of these structures. A task group is being formed to address the inspection of these structures.

Given the wide variety and large number of these structures that are in existence, inspection of these structures leads to many interesting challenges. The goal of the task group will be to bring together States in a forum to share their experiences and present case studies. Quantification of the problem as well as discussion of current inspection methods will be given special emphasis.

The NDEVC has also begun work on an effort to develop automated ultrasonic testing methods for use in steel bridge fabrication. Currently, many states require steel fabricators to use radiographic testing as the primary inspection technique for assessing the quality of welds. Ultrasonics (UT) can provide similar information and may be able to do so in a safer and more cost effective way. Currently, however, UT inspection of welds is an operator controlled technique that does not provide a permanent record of findings. Automating the process could reduce the reliance on the UT operator and provide the requisite permanent record.

A working group has been formed under the AASHTO/NSBA Steel Bridge Collaboration to focus on this topic. This working group, chaired by Glenn Washer, will examine existing technologies in the bridge fabrication industry as well as in other industries and will provide recommendations for future implementation.

More information about either of these projects can be obtained by contacting Glenn Washer at (202) 493-3082.

HERMES II

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from previous HERMES system testing, signal processing, and field performance evaluation as needed.

Recent work at the NDEVC to prepare for the upcoming HERMES II project has involved test specimen design and fabrication, computing facilities development, radar modeling development, signal processing, and improving ground truth data comparisons to HERMES results. These developments will allow the future validation of the HERMES II system to proceed effectively and efficiently.

More information about the HERMES II study can be obtained by contacting Mike Scott at (202) 493-3124.

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