Evaluation of Phased Array Ultrasonic Testing for Bridge Inspection

Final Report

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16 **Abstract**

Traditional ultrasonic flaw detectors have been used for testing bridge pins and light tower anchor bolts for defects that cannot be detected with a visual examination. Traditional equipment as some limitations on the amount of information provided to the operator. Phased array equipment has the potential to provide more information to the operator, thereby improving the quality of the inspection. Increased complexity in operation and set-up of equipment was noted along with the need for additional operator training. Overall, the benefits of the additional information provided to the operator with the use of phased array equipment outweighs noted drawbacks. Inspections were performed in less time and with greater operator confidence than with multiple scans using traditional equipment. This is attributed to the additional information provided in a single scan with the phased array equipment.

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Purpose: To evaluate the use of phased array flaw detection equipment for the inspection of bridge pins and light tower anchor bolts.

Background: Traditional ultrasonic flaw detectors have been used for testing bridge pins and light tower anchor bolts for defects that cannot be detected with a visual examination. The traditional equipment is limited on the amount of information that is provided to the operator. Phased array equipment has the potential to provide more information to the operator, thereby improving the quality of the inspection.

Equipment: Following procedures for equipment purchases using federal funding, the Department acquired an Olympus OmniScan MX2 phased array ultrasonic flaw detector. The unit came equipped with a 16x64 manual scan module. This module allows for the sequenced operation of up to 16 transducers with the compiled results displayed. The purchase also included two phased array probes and basic operator training. The probes each contain 16 transducers in one package.

Evaluation: The unit was utilized in the inspection of bridge pins in the Gordon Drive Viaduct in Sioux City and light tower anchor bolts at several locations throughout the state. A Krautkrammer USN 58R ultrasonic flaw detector was also used at these locations to provide a comparison to traditional methods. The phased array equipment allowed continuous scanning across a range of angles with the results displayed as one composite image. Covering multiple angles with traditional equipment requires multiple scans using transducers at specific angles and the operator compiling the results mentally or through note taking. While preparing for inspections with reference samples, know defects were much easier to locate with the phased array equipment than with traditional equipment. When evaluating actual bridge pins and anchor bolts, the additional information made it much easier to discern geometry and acoustic coupling reflections from potential defects. Due to the small size of the individual transducers in the multi-element probes, the phased array scans are limited in the depth of penetration. In the event that traditional transducers are required, the phased array unit is capable of operating as a traditional flaw detector. It should be noted that this evaluation only compared manual scanning using multi element phased array probes with manual scanning using discrete element traditional probes. Other configurations of ultrasonic testing may be used based on the item being tested.

The use of phased array equipment was not without some drawbacks. With the increased capabilities comes increased complexity in operating the equipment. Additional operator training is required beyond what is necessary for traditional ultrasonic testing. Setup of the equipment for a specific task is more complicated and requires additional time. The equipment is also larger and heavier than traditional equipment. The cost of phased array equipment is significantly higher than traditional equipment.

Conclusion: Overall, the benefits of the additional information provided to the operator with the use of phased array equipment outweigh the drawbacks. The inspections were performed in less time and with greater operator confidence due to the additional information provided in a single scan with the phased array equipment than with multiple scans using traditional equipment.