TIDC Transportation Infrastructure Durability Center AT THE UNIVERSITY OF MAINE

Electromagnetic Detection and Identification of Concrete Cracking in Highway Bridges

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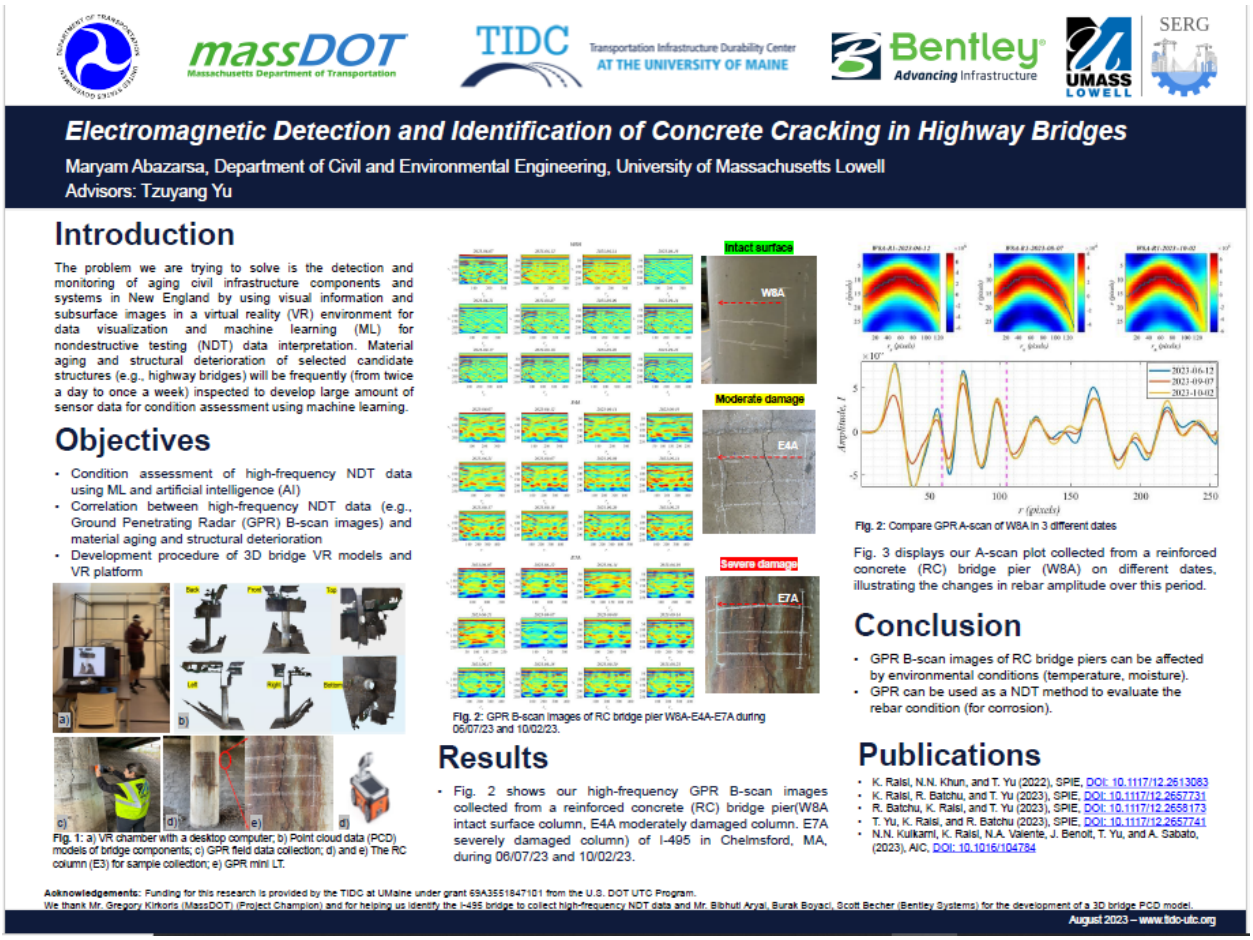
Abstract

Bridge structures, being critical to human life, we need a powerful method for continuous monitoring and maintenance to ensure their prolonged lifespan. Non-destructive testing (NDT) methods have become indispensable in civil engineering for assessing the integrity, quality, and durability of materials without causing damage to the structure. Ground penetrating radar (GPR) is one of the NDT methods that use operates on the principle of sending electromagnetic pulses into the ground to explore and image subsurface. In this research we are trying to solve the crucial task that is detecting and monitoring aging civil infrastructures in New England. Our approach involves utilizing visual information and subsurface images obtained through ground-penetrating radar (GPR) within a virtual reality (VR) environment for enhanced data visualization. Additionally, we employ machine learning (ML) techniques for the interpretation of the gathered data to obtain a pattern of material degradation. For our case study, we have focused on a reinforced concrete (RC) highway bridge (I-495, Chelmsford, MA), selecting it as a representative infrastructure component for high-frequency nondestructive testing (NDT) inspection. we used GPR to scan bridge columns to collect data for our investigation. The application of GPR in this context is aimed at providing valuable insights into the condition of subsurface materials and understanding of the aging mechanisms and structural integrity of the chosen bridge.

Our findings suggest that GPR B-scan images of reinforced concrete bridge piers can be influenced by environmental conditions, such as temperature and moisture. Despite these influences, the study concludes that GPR proves to be a viable NDT method for effectively monitoring the condition of subsurface steel rebars, particularly in the context of corrosion monitoring.

Keywords: GPR, NDT, corrosion, machine learning, virtual reality, material degradation



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