Acoustic Emission Studies for Non-destructive Evaluation (NDE) of Bridge Cables

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INTRODUCTION

Highway bridges, being crucial components of a healthy and economically productive transportation infrastructure, need field proven non-destructive technology for efficient inspection procedures that can reduce or eliminate maintenance, minimize uncertainty in decision making, reduce inspection frequency, extend bridge life, quantify damages and thus predict remaining bridge life, save human lives, time and money.

Acoustic Emission (AE) Sensor Technology for non-destructive testing (NDT) of highway bridges can provide field proven technology for achieving this goal. The AE technology is based on the fact that failures redistribute internal stress resulting in formation of elastic waves[1-4] and has advantage over the other NDT methods in detecting the damage in real time. This study used AE to assess the condition (such as corrosion, crack expansion and rubbing, wire breaks, and similar active defects) of strands on a single stay-cable, from anchorage point to anchorage point, of the Varina-Enon Bridge[5, 6] that carries I-295 and crosses over a shipping channel, the James River, which leads to Richmond Marine Terminal on the West and Norfolk/Portsmouth terminals on the East. Testing was performed over short durations of time during periods that included low traffic volumes (acoustically quiet) and high traffic volumes (acoustically noisy). Sources and locations of acoustic events have been determined using AEwin computer software. AE events generated inside the pylon in the saddle region of the test cable were detected. Although AE responses from the stay-cable did not contain any signatures of rubbing from previously broken cable and/or breaking during the testing period, AE signals were detected from the anchorage region.

This study reports the results of a short term evaluation of one of the stay cables using a 16 channel AE data acquisition (DAQ) system (Sensor Highway IITM from Physical Acoustics Corporation). The AE sensors were installed at strategic locations in between the anchorage points and in the saddle area. The results of the AE study and analysis of the data, transmitted through broadband wireless modem installed on the DAQ system to the remote desktop on a window platform, are reported.

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