Project title:
Three Integrated Projects to Enhance Non-Contact Rail Inspection Technology for Application to Substructure Health Evaluation on Both Rail and Road Bridges

Principal Investigator:
Dr. Elizabeth K. Ervin, Department of Civil Engineering, The University of Mississippi, eke@olemiss.edu, (662) 915-5618
Co-Principal Investigators:
Vyacheslav Aranchuk, National Center for Physical Acoustics, The University of Mississippi, aranchuk@olemiss.edu, (662) 915-5610
Dr. Christopher Louis Mullen P.E., Department of Civil Engineering, The University of Mississippi, cvchris@olemiss.edu, (662) 915-5370
Dr. James P Chambers, National Center for Physical Acoustics, Department of Mechanical Engineering, The University of Mississippi, chambers@olemiss.edu, (662) 915-5100

Start date: August 1, 2012
Completion date: December 31, 2013

Project description:
American infrastructure is in a precarious state. Bridges are susceptible to damage through both aging and abnormal events, and their remaining life is difficult to estimate. For example, the gusset plate defect was known before the I-35 collapse in Minneapolis; the effect of that local inspection to the overall health of the structure was not identifiable. To be addressed in this work, the technical gap is the identification of global dynamic property changes resulting from significant local component damage, such as stress corrosion cracking, a barge impacting a pier, or hurricane storm surge.

The three applied research projects in this effort will reach toward the goal of advancing inspection of transportation infrastructure in order to improve public safety and economic competitiveness. Non-contact rail inspection techniques are well developed but have not been applied for substructure evaluation. Furthermore, these techniques have not been applied to highway infrastructure. This integrated effort will extend rail technology to generate an inspection methodology for bridge substructure evaluation. The main objective is the determination of structural state from local materials to global assembly at any instant. This objective will be achieved by computational evaluations on three experimental setups. Employing state-of-the-art non-contact measurement, the sensitivity of various structural health monitoring algorithms will be evaluated for both rail and highway structural data while considering potential noise factors. With its intermodal connectivity, the new integrated inspection will be more efficient, more cost effective, and more accurate than traditional techniques. With appropriate adjustments in data processing algorithms, the techniques herein will be applicable to any bridge; however, the scope is limited to overall health so that subsequent local inspection may be indicated.