MISTRAS
A World of NDT Solutions
Products & Systems Division

Application Brief

AE SENSOR HIGHWAY II™ For Steel Bridges
~ The Second Generation Wireless Local Area Monitor ~

Introduction

The use of Acoustic Emission (AE) for testing and monitoring of steel bridges has been of ongoing interest to the Federal Highway Administration (FHWA). During the early 1990's Physical Acoustics Corporation, a member of MISTRAS Group, demonstrated the use of AE for over a dozen different bridges around the U.S, and created a set of guidelines for AE bridge monitoring. This effort resulted in a cooperative agreement with FHWA to design and fabricate a portable AE monitoring system; the 1st generation Local Area Monitor (LAM).

http://www.tfhrc.gov/hnr20/nde/acoustic.htm

Field Installation & Mounting Bracket

Bridge Inspection To Date

Since 1992 FHWA has collected and maintained a database of information for over 590,000+ bridges called the National Bridge Inventory (NBI). This database summarizes the information collected by each state regarding the number of bridges, material type, location, age, structural appraisal, sufficiency rating, functional classification and costs of improvement. The information collected for NBI relies primarily on the use of visual inspection. While this has been the accepted practice for bridge inspection, it can often be subjective and does not account for hidden subsurface defects and/or discontinuities, as well as deterioration in difficult to access areas. Given the rising demand for ensuring the integrity and performance of our nation's bridges, traditional visual inspection can be supplemented with NDE technologies in a complementary arrangement that provides additional information regarding the structural integrity. This will help bridge authorities make more effective and informed decisions with regard to repair, rehabilitation, replacement and maintenance planning.

FHWA Steel Bridge Testing Program

For the second time, FHWA has chosen PAC's AE Sensor Highway II™ (2nd generation LAM) for use in the Steel Bridge Testing Program. FHWA will conduct laboratory and field demonstrations for bridge owners, consultants, and others in the bridge industry on the application of the AE Sensor Highway II™ technology for bridge inspection; an added technology to the bridge inspectors toolbox!

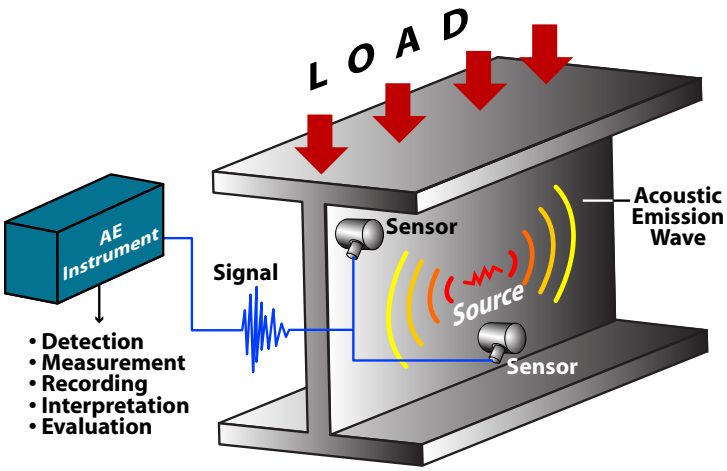
AE Sensor Highway II™

The AE Sensor Highway II™ system is designed to:

- Monitor the effectiveness of repairs/retrofits
- Determine if pre-existing/known defects are active
- Monitor "hidden areas" where visual inspection is difficult
- Determine if high stressed areas show flaw-like activity

What is Acoustic Emission (AE)?

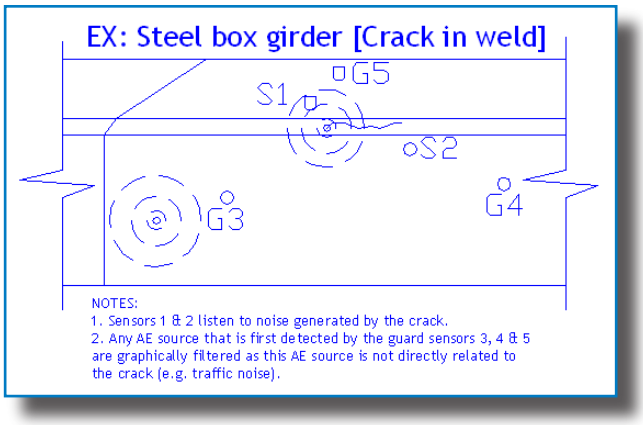
Acoustic Emission (AE) is a nondestructive monitoring technique that can detect changes in structural integrity caused by defects (cracking, corrosion, etc.)



or discontinuities that become active during typical operating loads, overloading conditions or degradation. Thus AE is defined as the rapid release of energy in the form of a transient elastic stress wave generated by an acoustic source that can be detected and recorded by AE instrumentation. There are a variety of AE sources that can be detected in various materials. For metals, typical sources include crack initiation, crack propagation, fretting (between crack faces, bolts), slipping (bearings) and fracture.

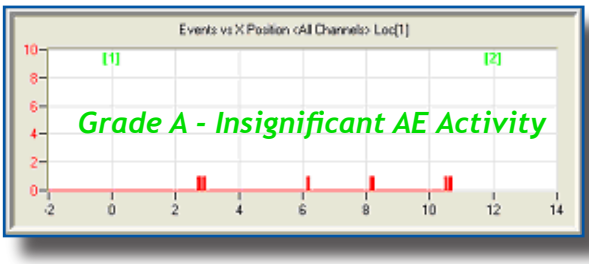
Crack Monitoring - How it Works

For collecting crack information with AE, one sensor is placed outside each end of the crack so that the crack is oriented along a path between the two sensors. This



configuration provides total coverage of the area of interest and determines if the crack tip is active (propagating) and if fretting (rubbing) of the crack faces is occurring.

Using built-in software algorithms, AE activity from the crack can be located. In this example, a total of 7 events were located over a 3 hour period under heavy traffic load.



Monitoring System for Structural Health

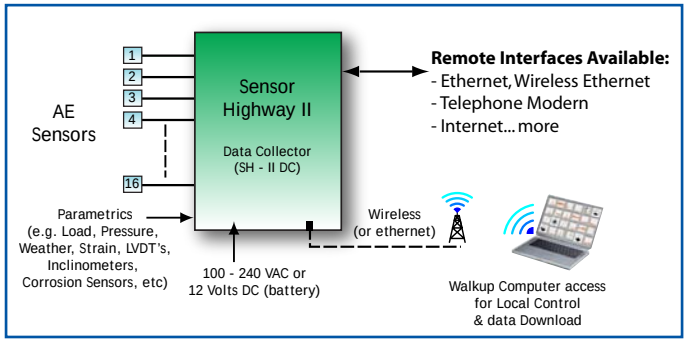
The Sensor Highway II System ™ is an Acoustic Emission (AE) monitoring system with up to 16 high-speed channels and 16 parametric input channels. The system is designed for unattended use in ***Structural Health Monitoring*** management and condition monitoring applications and is enclosed in a rugged outdoor NEMA 4 enclosure capable of operating in extreme weather and factory conditions.

Your Application Solution

The key feature of the Sensor Highway II System™ is its highly flexible sensor fusion interface for input and processing using a variety sensors. The system is able to accept AE sensors (using the standard "phantom power" coaxial connection for powering external preamplifiers), ICP (Amplified) accelerometers, and various sensors with current and voltage outputs. This interface is accomplished through the use of standard industrial, DIN Rail Mounted Signal Conditioning Modules, with options for Proximity Probes, Tachometers, Pressure Transducers, Load Cells, Thermocouples, Environmental Sensors, Strain Gages, and more.

The Sensor Highway II™ has several interfaces available for data communication and remote control. The principal interface is the built-in Ethernet 10/100MB port (or optional wireless Ethernet). Other available interfaces include: Telephone modem, RS-232/485, USB host and device, 4 – 20ma and digital I/O, and relay outputs for alarm and control purposes.

Data download can be accomplished via a walk-up attachment by plugging in a notebook computer through its standard Ethernet port, or through an automated remote interface, via wired/wireless Ethernet, internet, or telephone modem, to a remote control and data processing station. The remote system, with the aid of a trained user, performs the data analysis and asset integrity assessment.



Sensor Highway II™ DC Wireless Data Collector System

Your Total NDT Solutions Provider

195 Clarksville Road, Princeton Junction, NJ 08550 USA
Phone: (609) 716-4000 • Fax: (609) 716-0706
Email: sales.systems@mistrasgroup.com • www.mistrasgroup.com