



## NONDESTRUCTIVE TESTING AND EVALUATION

### Acoustic Emission (AE)

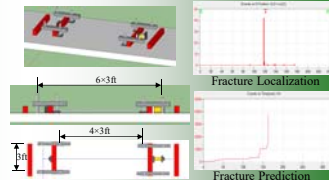
• AE is the sound waves produced when a material undergoes stress (internal change) as a result of an external force. The 32-Channel Micro-II AE System is designed to monitor the AE signals.



### Cable Tension Test

**Objective:** to locate and predict the exact fracture location during tension tests

**Test Setup**



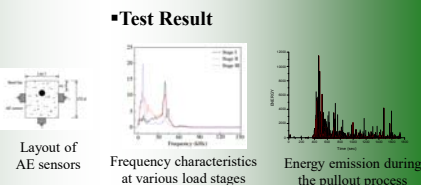
**Conclusions:**

- 1) The AE system can locate the source of fracture with good accuracy.
- 2) The yielding process is captured as a pre-cursor for fracture.

### Pullout Test of Corroded RC Specimens

**Objective:** to study the AE signal characteristics during the pullout process

**Test Setup**



**Conclusions:**

- 1) Various load stages are identified by different frequency characteristics of AE.
- 2) The AE energy release over time corresponds to the load-induced slip process, giving good failure prediction and pullout process evaluation.
- 3) The characteristic frequencies of corroded and uncorroded specimens are quite different. Their comparison gives a reliable indication of corrosion.

### AE Applications in Civil Engineering

- Corrosion Monitoring
- Fatigue and Impact
- Bridge Monitoring
- Weld Monitoring
- Concrete Cracking

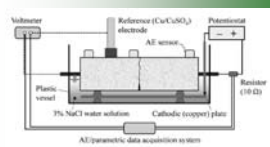
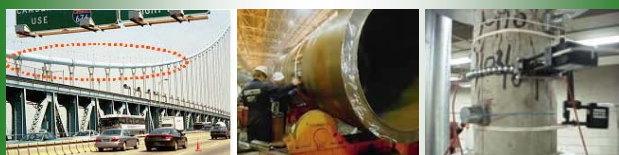


Fig. 2—Test setup schematic for accelerated corrosion.



### Laser Vibrometer

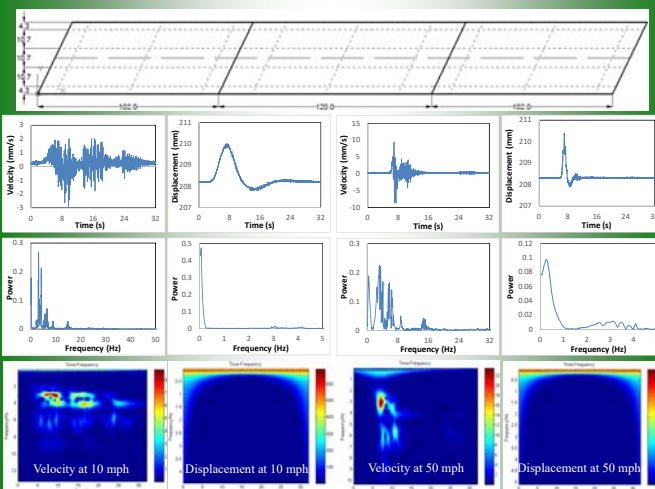
• Laser Vibrometer RSV-150 is designed for point-and-shoot monitoring and structural dynamics testing from a distance. It is a non-contact test method that can be rapidly set up for field applications.



### In-situ Testing of a Three-span Continuous Prestressed Concrete Box-girder Bridge

**Objectives:**

- To quantify the dynamic impact factor associated with the driving speed of a truck by measuring the time histories of velocity and displacement.
- To evaluate the structural condition of the bridge with frequency features extracted from the vibration.



**Conclusions:**

- 1) The laser vibrometer can measure the time history of vibration.
- 2) The frequency features can be obtained from the time history data.

### Potential Applications of Laser Vibrometer in Civil Engineering

- Elevated structures: bridges, high-rise buildings, towers, and water tanks.
- Structures in high temperature environment: furnaces, steam pipes, and nuclear reactors
- Structures in hazardous environment: high-voltage switchers/stations and waste treatment plants/facilities.



**Sponsored by: Missouri Department of Transportation and CTIS University Transportation Center at Missouri S&T.**