Installation Case Study
Arsenal Bridge

Rock Island, Illinois, USA
Arsenal Bridge - General Characteristics

- Constructed 1896, Steel Through Pratt Truss, 8 Spans
- Combined Two Lane Highway-Railway Structure
- Length: Rail (Spans 1-8) 1,848 ft, Vehicle (Spans 2-6) 1,556 ft
- 360° Swing Span 2: 336 ft, 2,000 Tons
- Swing Span Average Turn Time: 12 Min
- Traffic: Rail 1,881/yr, Vehicle 10,297/day, Barges/Boats 18,568/2,884/yr
**Arsenal Bridge – Structural Monitoring System Overview**

<table>
<thead>
<tr>
<th><strong>Aim</strong></th>
<th>To monitor the integrity and behavior of the bridge structure, and effects due to high traffic and heavy truck loads that could cause possible damage &amp; fatigue.</th>
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<tbody>
<tr>
<td><strong>Location</strong></td>
<td>Rock Island, IL</td>
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<tr>
<td><strong>System Integrator</strong></td>
<td>Chandler Monitoring Systems, Inc. <a href="http://www.chandlermonitoring.net">http://www.chandlermonitoring.net</a></td>
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<td><strong>Customer</strong></td>
<td>Concurrent Technologies Corporations</td>
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<td><strong>Instrumentation</strong></td>
<td>(1) Luna sm130-500 Optical Sensing Interrogator (1) Luna sm041-416 Optical Channel Switch Extension</td>
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<td><strong>Sensors</strong></td>
<td>(36) Luna os3100 Strain Sensors (21) Luna os4300 Temperature Sensors (10) Luna 3D Accelerometers (1) Fiber Optic Tilt Meter Conventional AE, weather and corrosion sensors</td>
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<td><strong>Project Scope</strong></td>
<td>Employ system on the bridge to greatly reduce risk of catastrophic failure by providing advance warning of growing structural problems caused by corrosion/materials degradation. Demonstrate and validate state-of-the-art and emerging innovative technology approaches for remote structural health and corrosion degradation monitoring of steel bridges.</td>
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Sensors were installed along the length of the entire structure, including the rail deck above and the road deck below.

The bridge is broken up into four different zones.
Zone 1: A total of 15 sensors cover the upper and lower deck.

Sensors consist of:
(6) Strain
(5) Temperature
(4) 3D Accel
Zone 2 - Arsenal side of the swing span.
- (13) Strain Sensors
- (6) Temperature Sensors
- (1) 3D Accelerometer
- (1) Tilt Meter

Zone 3 – Davenport side of the swing span.
- (11) Strain Sensors
- (4) Temperature Sensors
- (1) 3D Accelerometer
Zone 4: A total of 15 sensors cover the upper and lower deck.

- Sensors consist of:
  - (6) Strain
  - (5) Temperature
  - (4) 3D Accel
Arsenal Bridge - Sensor Network Configuration

Splice Tray Cable Color Guide
Arsenal Bridge - System Configuration

The monitoring system instrumentation is composed of:

- Single optical interrogator (model sm130-500), 1Khz, 4 channels
- 4x16 channel sensor multiplexer (model sm041-416)
- sp130 controller and data acquisition module
FBG sensor arrays were pre-assembled to length for each bridge segment.
Once on-site, sensors are unpacked and prepared for installation.

Access via man-lift and scaffolding
Arsenal Bridge – Installation of Swing Span Sensors

3D Accelerometer being installed on the swing span
Arsenal Bridge – Installation (Splicing to Trunk FO Cable)

Tapping into the main cable feed at various locations along the bridge. *(above)*

Main cable feed tapping point and industrial grade IP69 splice tray. *(below)*
The optical system is housed inside a NEMA rated box with controlled temperature and humidity.

Control House with optical panel in attic.
IntelOptics Software

- Chandler Monitoring Systems’ customized GUI software
  - Monitors, gathers data and provides alerts and analysis when various sensing systems approach or exceed established limits.
  - Communicates with numerous sensing systems to display status and provide information in one centralized user program which can be accessed remotely.
  - Electrical Resistance Corrosion Sensors, Weight in Motion Sensors, Weather Stations, Security sensors, and Water depth sensors are some sensors that may be fully integrated into the IntelOptics™ software.

- Luna’s ENLIGHT application software is used for FBG sensor setup and to stream sensor data to IntelOptics™.
Arsenal Bridge – Results and Acknowledgements

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■ Keith Chandler of Chandler Monitoring Systems, Inc., system integrator and on-site installer.